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USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 18/81)

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BIOCHEMISTRY

UDC: 577.352

MEMBRANE BIOPHYSICS

Moscow BIOFIZIKA MEMBRAN in Russian 1981 (signed to press 16 Jan 81) pp 2, 316-319

[Annotation and table of contents from book "Membrane Biophysics", edited by L. A. Blyumenfel'd, printed from an original prepared by the Institute of Biological Physics, USSR Academy of Sciences (Pushchino), Izdatel'stvo "Nauka", 1900 copies, 331 pages]

[Text] Biophysics of membranes covers a significant part of modern biological physics. Such basic processes as utilization of energy released from tissular respiration and photosynthesis, active transport of ions, etc., are related to the function of membranes. This collection includes generalizing articles from several prominent scientific research laboratories of our country concerned with membrane biophysics. There is approximately the same amount of material dealing with two main problems: structure of membranes and electrical characteristics of natural and artificial membranes. The collection will find numerous readers among physicists, biologists and chemists working in this intensively developing branch of science. [Russian abstracts are provided].

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LEVELS OF ORGANIZATION OF BIOLOGICAL SYSTEMS

Moscow UROVNI ORGANIZATSII BIOLOGICHESKIKH SYSTEM in Russian 1980 (signed to press 22 Sep 80) pp 2-7, ...

[Annotation, foreword by Prof A. M. Molchanov and table of contents from book "Levels of Organization of Biological Systems", edited by A. M. Molchanov, doctor of physicomathematical sciences, Scientific Council for Problems of the Biosphere, Scientific Research Computer Center, USSR Academy of Sciences, Izdatel'stvo "Nauka", 2600 copies, 104 pages]

[Text] This collection is comprised of material submitted at the fifth and sixth lectures ["schools"] on mathematical modeling of complex biological systems. There is discussion of the principles of organizing of living systems on different levels. Special attention is given to the study of the structure and functions of a complex biological system on the organismic level. The book is intended for a wide circle of biologists.

Foreword

Statistical processing of experimental data is familiar to both biologists and mathematicians, and it is the traditional form of using mathematics in biology. True, in most cases this amounts to calculation of means and dispersion. If, however, a law of distribution (histogram) is constructed, this is, of course, higher mathematics.

The reader will not find anything like this in the collection offered to him. The purpose of this collection is to draw the attention of mathematicians to the distinctions of theoretical constructions inherent in biology.

The most obvious, superficial conclusion is that biologists and mathematicians speak in different languages. However, if this is all there was, it would hardly be necessary to conduct a school and publish a collection of lectures delivered in this school by biologists for mathematicians.

It is worthwhile to take a closer look at the reasons for such a difference between the languages of biologists and mathematicians. The most popular view of the cause of the difference is that life is complicated and mathematics is simple, and that is all there is to it. To counter this point of view, we have only to try to analyze the historical causes of disagreement between biological and mathematical approaches.

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The essence of the mathematical approach can be described in one word--axiomatics.

The axiomatic method has brilliantly made a name for itself in geometry, and for 2 thousand years it was the example for constructing strict theory. Remarkable researchers, from Copernicus to Laplace, who created celestial mechanics, proudly called themselves geometricians and in their hands the axiomatic method won, we would say, the most remarkable victory, which enabled natural science (in the guise of Laplace) to declare that they do not need the hypothesis of a creator to interpret celestial phenomena. This renders all the more paradoxical the viability of vestiges of theology in matters that are strictly earthly, in problems of life, in the study of biological phenomena. One of the important reasons for this is the inconsistency, which is obvious at first glance, of the axiomatic approach to biology, the virtual helplessness of mathematical methods.

The articles assembled in the collection offered to the reader's attention clarifies the situation somewhat. The foundation of any mathematical scheme is to single out elementary elements. In geometry this refers to points, lines and planes, in celestial mechanics to tangle points and in physics to elementary particles.

It is in this main point--determination of an elementary object--that axiomatics apparently has no chances of success in biology. While advancement of cell "theory" in the last century prompted optimism, the farther research progressed, the more obvious it became that the cell is not an elementary object in any sense of the word. It was learned that cells are just as diversified as the previous "pretender" to the role of elementary object--the organism.

Some time ago, it appeared that molecular biology would provide the long awaited theoretical basis for including biology in the orbit of precise natural sciences. But at present there are few who share these hopes, even with reference to the problem of structure and function of cellular organelles, not to mention the cell itself. Even so, the potential of expressly the axiomatic method is still far from being exhausted in biology.

However, the very concept of axiomatic approach requires serious definition. The main topic of axiomatics can be formulated as follows: after difficult, sometimes over many centuries, screening and selection of experimental facts, one succeeds in singling out the basic elementary objects and concepts in such a manner that all the rest of the experimental data can be derived (and defined!) by pure logic from these main elementary axioms. But the entire point is that not only tangible objects may be elementary ones; we can also refer on a par with them to elementary relations (links) and elementary processes.

While elementary objects (material [tangible] points, particles, stars) have been studied very closely by researchers, relations and links are studied much less often. The classification of Linnaeus is perhaps the greatest advance in this direction of biology; it has a formal attitude toward objects (organisms), but its actual subject is referable to relations, accessories.

But elementary processes really had bad luck. The very formulation of the question of existence of elementary processes sounds heuristic. "Can one really study a process, motion per se, regardless of what is moving?" And, although this is actually what mathematical analysis is concerned with for several centuries, a clearcut formulation usually elicits resistance and distrust, not only among biologists, but even physicists.

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Perhaps the main result that can be achieved from interaction of biologists with mathematicians consists of the following. Biology differs decisively from "mathematical natural science" in that it is extremely "inconvenient" for any and all frameworks and formalizations. It is utterly unrealistic, at least at the present time, to hope to construct a sole theory of biology, like physics. Nevertheless, the extremely rich biological material can and should be formalized by expounding special theories constructed by the axiomatic example.

We could conceive of a table of theories with three inputs [accesses]. One lists elementary objects, the second lists elementary relations and the third elementary processes. Each special theory takes on several "boxes" from each of the accesses (in particular, one from each), and the most elementary ones deal with either one elementary object, or relation, or process. Two important requirements must be imposed that definitively distinguish the most elementary theory from the most complex model.

In the first place, there must be good formulation of postulates in the theory--main, elementary objects, relations and processes. In the second place, any theory must include the range of its applicability. Of course, it would be desirable for this range to also be examined theoretically, but we can mention the tentative experimental conditions, under which applicability of the theory is impaired. We should take axiomatics from mathematics and the principle of conformity from physics. But, unlike physics, which represents the "principle of conformity" hierarchically, where new theory embraces the old and contains it as a special case, in biology theories must be more equal [with equal rights], and it is significant that there is an overlapping zone between theories. Formally, this can be described as follows: for a pair of theories A and B there must be a theory C which is the extreme case for both theory A and theory B. In other words, there may be conditions when only A is true, conditions when only B is true, but there are also conditions when both theories lead to the same conclusions (theory C).

The principle of conformity [accordance, correspondence] in biology does not allow us to expect that such a situation occurs with any two theories; they must not necessarily have objects in common like species that separated long ago. However, in complete accordance with the picture of origin of species, any two theories must be connected by a chain of combined theories.

The present status of science (and, in particular, the part on the boundary between biology and mathematics) predetermines the need for axiomatic analysis of at least three "hypostases"--elementary objects, elementary relations and elementary processes.

The desire for synthetic constructions is understandable and warranted; however, their invalidity is attributable, first of all, to the unilateral nature and inadequacy of prior analysis.

Let us consider the contents of this collection from these general vantage points.

In the article by B. M. Mednikov, analysis is made of the range of applicability of classical mathematical genetics. Its main ... [portion of source cut off] ... when turning to more complex objects and deeper problems becomes rather approximate and, not uncommonly, wrong. In particular, it is not only the rectilinear principle of "one gene--one trait" that is invalid, but the considerably more compromising one of "one gene--one enzyme."

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The article of V. V. Malakhov deals with comparative morphology. Among biologists (as well as mathematicians), it is usually believed that morphology is a truly biological discipline that has no analogues in other sciences. Yet analogous ideas and approaches have been developed in precise natural science. The best developed example is theory of internal stellar structure. The famous diagram of Hertzsprung-Russell (correlation between mass and luminosity) is the arrangement of the star population in a comparative morphological series. The next step is the attempt to interpret this series from the standpoint of evolution. For the time being, experiments on stars are impossible, even in one's imagination, so that it soon became necessary to conduct computer model experiments. A comparison of the results of calculations to experimental data led to the conclusion that evolution does not proceed always by far along a comparative [relative] morphological series. There are situations when a morphological series is a line of forms that develop in parallel. This is a useful lesson for biology also.

There is one more curious comment that ensues from the above analogy. It pertains to the problem of the "missing [lost] link." On the "mass--luminosity" diagram there are striking gaps. Apparently, expressly these gaps have a profound evolutionary (and not only morphological) meaning and correspond to rapid stages of evolution. There are grounds to relate them to interesting periods of oscillatory stages ("Cepheids") and explosive stages ("novas" and "supernovas") in evolution of stars.

In the article by M. V. Mina, there is analysis of the concept of "species," which is so important to any evolutionary constructions in biology. Theoretical and practical necessity have long since reduced the question of characteristics of a species to the question of interaction of populations that make it up, and this article discusses mainly the content of the concept of "population." The author stresses the fact that existing approaches are inadequate and limited; all of them are, as a physicist would express it, "quasistationary." Yet time characteristics are very important, not only theoretically but from a strictly practical point of view, with such intensive changes in the landscape occurring in our times, which are related to man's endeavors.

The article by A. S. Severtsov, "Evolution of Mechanisms of Amphibian Food Grabbing and Respiration," stands somewhat apart from the others. It is of interest to interaction between mathematics and biology for three reasons at once. In the first place, he provides an example of a full-blooded biological problem and leaves no hope that modern meager ["emaciated"] mathematical models based on elementary physicochemical or cybernetic conceptions could interest biologists who are oriented in the classical direction. In the second place, it demonstrates a different approach to the idea of elementarity, to the concept of "substantial variables," where spatial "divisibility," physical "divisibility" and other "non-atomic" factors recede to the background, as compared to decisive functional indivisibility. A most interesting methodological question comes immediately to mind: can one formalize and, if so, how can one formalize, mathematize such constructions. There is also a "third interest," having a direct bearing on the "news of the day"--intensification of ecological processes. But for this, it is best to give the author the floor.

The "tandem" articles by S. P. Maslov "Restriction of Possibility of Homeostasis by Multifunctionality and Main Routes for Bypassing It," and by A. S. Severtsov, "Functional Differentiation of the Organism in the Course of Phylogenesis," are of

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special interest to mathematicians. The main point of these works is that evolution compelled virtually all organs and system to function not only for their immediate purpose, but many other duties. Obviously, this leads to drastic decline of efficiency. However, in compensation, the same function can be performed in different ways. This is a rather curious situation, where "every element is concerned with the business of another," apparently has profound evolutionary meaning, and quite probably it is related to the basic nonlinearity of biological systems. From the standpoint of mathematics, one could try to conceive of the situation (of course in a quite simplified and modeled way) as follows: When there are mild exogenous factors (under "comfortable" conditions), homeostasis is provided by specialized organs (if you wish, this is the definition of specialization). Then, as the situation grows increasingly complex--with increase in exogenous loads--more and more interaction is needed--"additional insurance" and, conversely, "de-parallelization" of systems--which leads to powerful overadjustment, which is observed both in the concrete act of excitation and individual development, as well as in the evolutionary aspect.

The ever increasing interest of mathematicians in the points of bifurcation, critical modes and complex kinetics must, sooner or later, lead mathematics to the "littoral." This should be interpreted both in the figurative meaning--on the boundary between mathematics and classical (qualitative) biology--and in the literal sense of the word--the really boundless problems and tasks that appear on the littoral, related to the littoral and because of the littoral.

An invitation to collaborate is the main purpose of the schools of mathematical modeling of biological processes.

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IMMOBILIZATION OF ENZYMES AND CELLS OF MICROORGANISMS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 16: BIOLOGIYA in Russian No 3,
Jul-Sep 81 (manuscript received 10 Apr 79) pp 72-78

[Article by I. P. Baranova, Yu. I. Kozlova and N. S. Yegorov]

[Text] Immobilized enzymes are insoluble and, because they can be readily extracted from a reaction system, they can be used many times in periodic enzymatic processes or continuously active columns. In some cases, immobilized enzymes are more resistant to exogenous factors than ordinary enzymes.

There is limited application of soluble preparations of some enzymes because of their high cost, low stability and difficulty of purification. Immobilized enzymes, i.e., enzymes artificially bound with a matrix, or stabilized ones (bound with bi-functional reagents), which retain part or all of their catalytic properties, do not have such flaws.

There are chemical and physical methods for immobilizing enzymes. Chemical methods include covalent bonding with chemically activated matrix--cellulose, porous glass, synthetic polymers. Physical immobilization methods consist of adsorption on carriers: concrete, silicates, metal oxides, activated charcoal, silica gel and ion exchange resins, glass, etc., as well as incorporation (microcapsulation) in gel, particularly PAAG [polyacrylamide gel?] ("Immobilized Enzymes," 1976; Skinner, 1975).

More recently, immobilized enzymes have found wide application in different sectors of the national economy. Immobilized amylase, glucoamylase and glucoisomerase are used in the food industry to recover syrup from starch with a high fructose content. Immobilized glucoisomerase (intracellular enzyme that catalyzes conversion of glucose to fructose) is used rather extensively in the paper, textile, chemical and pharmaceutical industries, as well as to treat liquid waste (Bruce et al., 1974).

Immobilized enzymes (in particular, pectin methylesterase) are used to clarify fruit and vegetable juices (Durand et al., 1975), while immobilized papain and pectinase are used in the Japanese food industry to clarify wines and juices (Skinner, 1975). Immobilized pepsin is used for continuous clotting of skim milk and immobilized invertase is used to obtain invert sugar (Skinner, 1975). Proteases (in particular, pepsin) immobilized on silica carriers are used for hydrolysis of casein (Kreen et al., 1976). Continuous hydrolysis of starch by immobilized amyloglucosidase has been described (Kucera, 1976).

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Information has been published on the use of immobilized enzymes for bacteriolysis, and this can also be used in the food industry. It was shown that it is possible to submit bacterial walls to continuous lysis in a reactor based on membranes with lytic enzyme (Karube et al., 1977).

In medicine, immobilized enzymes have found applications in diagnostics, clinical analysis and as drugs (Baum, 1977). Instances have been published of using immobilized enzymes, such as streptokinase, catalase and asparaginase, as therapeutic biologicals (Selezneva et al., 1977). Immobilized asparaginase is used to lower patients' blood asparagine levels (Korsakevich et al., 1977).

There is an interesting method of dissolving blood thrombi and similar structures by means of immobilized streptokinase (Ginger, Mather, 1976).

There is also discussion in the literature of the use of immobilized enzymes (catalase, asparaginase and others) in medicine, medical technology as material to create artificial organs--kidneys, blood vessels and others--as well as in diagnostics (in particular, an enzymatic electrode for assaying blood sugar; Murati Takasi, 1978).

It is believed that immobilized enzymes should find wide application in clinical tests (Mattiasson, 1976). Immobilized glucose dehydrogenase is used for continuous glucose assays, which permits determination of glucose content of biological fluids and could be used in clinical tests (Bisse, Nonderschmitt, 1977). Immobilized glucose dehydrogenase is also used to measure plasma glucose (Kuan et al., 1977).

There has been a description of the use of immobilized cholesterol esterase and cholesterol oxidase to assay serum cholesterol by the polarographic method (Huang et al., 1977).

Immobilized enzymes have found applications in antibiotic production. For example, immobilized penicillinase was used for continuous demonstration of penicillin formed in the culture fluid of *Penicillium chrysogenum* (Hornby et al., 1974; Rusling et al., 1976). Inexpensive 6-APK [aminopenicillanic acid] is obtained by means of benzylpenicillinase immobilized in PAAG, and then used to produce semisynthetic penicillins (Kestner et al., 1973; Mandel' et al., 1975).

The possibility of using immobilized trypsin and lysozyme to purify air is being discussed. These enzymes were immobilized by means of covalent bonding with glass fibers. A filter with immobilized trypsin is impervious to many viruses. A filter containing immobilized lysozyme retains up to 87% *Micrococcus lisodeiticus* and up to 97% *Escherichia coli* (Enright, Gainer, 1976).

There is discussion in the literature of general principles of using immobilized enzymes for detection and continuous monitoring of toxic substance levels in air and water (Goodson, Jacobs, 1974). Highly sensitive methods can be developed on the basis of immobilized enzymes for automatic monitoring of insecticides, organophosphorus compounds, etc., which is important to safeguard the health of agricultural workers involved in harvesting citrus and grain crops.

There are indications that it is possible to use immobilized enzymes for fine organic synthesis in hydroxylation, dehydrogenization and phosphorylation reactions (Skinner, 1975). In Japan, separation of racemic mixtures of D and L amino acids by means of immobilized enzymes has been set up. L-amino acids--methionine,

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phenylalanine, threonine and valine--were successfully separated from their racemic mixtures using immobilized aminoacelase (Skinner, 1975). There is discussion of the technological process of recovering L-citrulline and 6-aminopenicillanic acid with immobilized enzymes. The principle is described of obtaining immunoadsorbents by means of covalent bonding of antibodies to a matrix for the immunoenzymatic method of analysis and affine chromatography (Skinner, 1975).

In recent years, experiments have been conducted in the USSR and abroad with non-multiplying immobilized cells of microorganisms. Use thereof may have a number of advantages over both free cells and immobilized enzymes, for example, it would make it unnecessary to purify enzymatic preparations and, in some cases, would avoid the difficulties related to the instability of enzymes. Moreover, immobilization of whole cells would make it possible to obtain polyenzymatic systems, and it does not require additional use of cofactors. The same methods and types of carriers are used to immobilize cells as to immobilize enzymes. Cells submitted to immobilization are directly incorporated in stabilizing material. For example, *Actinoplanes missouriensis* cells were incorporated in cellulose fibers at 70-80°C retaining 40-45% of their capacity to isomerize glucose.

Electron microphotographs have shown that cells are incorporated directly into fibers, and this changes the structure of fibers (Linko et al., 1977). There was complete loss of enzymatic activity when the fibers with cells were dried in a vacuum.

Many single-stage processes, including isomerization, oxidation, reduction and dehydration reactions, are performed with immobilized cells ("Immobilized Enzymes," 1976). Most of the work with immobilized cells has dealt with transformation of steroids (Skryabin et al., 1974; Koshcheyenko et al., 1975). However, immobilized microbial cells can also perform purely biosynthetic processes.

Immobilized cells can perform multistep processes, for example, propionic acid fermentation, in which 19 enzymes are involved (Vorob'yeva et al., 1977), or fixing molecular nitrogen by bacterioids of rhizobia, in this case replacing polyenzymatic systems (Yevstigneyeva et al., 1975).

The facts accumulated to date enable us to speak of the existence of certain differences in behavior of free (intact) and immobilized cells. Immobilized cells are more stable during storage and prolonged culturing. Their enzymatic activity is somewhat altered. They can be readily separated from a medium consisting of a solution of metabolizable substrate. They have a broader optimum temperature. For example, *Corinebacterium glutamicum* cells entrapped in gel synthesized glutamic acid in a complex biosynthetic medium for 144 h. The same free cells performed such synthesis in considerably smaller quantities than immobilized cells during 120 h of cultivation (Slowinski, Charm, 1973).

Immobilization of cells affects vital metabolic processes of microorganisms. It has been reported that immobilized cells do not multiply in gel. Physiological aging of the culture occurs; the cells isolated from gel are less viable and less thermostable. It has been demonstrated that the rate of renewal of ³H-thymidine labeled DNA is significantly higher in intact *Lactobacillus casei* cells than immobilized ones (Divies, 1977). Immobilized *Saccharomyces cerevisiae* cells cultured after removal from gel had a lower reproductive capacity than cells in

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a period culture (Kierstan, Bucke, 1977). In some cases, the immobilization process had little effect on activity of enzymatic processes in cells, and there was a rather high yield of end product. Decarboxylation of malic acid in a lactic culture of *Lactobacillus casei* occurs at pH 3-6, and by immobilized cells it occurs at pH 3-7, i.e., there is some increase in range of pH for enzyme activity, although its optimum value is retained. This process proceeds quantitatively for 12 months when fresh medium is delivered into the column, which contains glucose, tryptone, yeast autolysate and mineral salts (Divies, Siess, 1976). In other studies, no difference was demonstrable in pH and temperature optimums (Sato et al., 1975; Ohmiya et al., 1977).

In some cases, the immobilization process causes appearance of new properties in microorganisms. Transgalactosidase components identical to raffinose were demonstrated in immobilized *Lactobacillus bulgaricus*, *Escherichia coli* and *Kluyveromyces lactis* cells, which had high β -galactosidase activity, i.e., they became capable of forming oligosaccharides from lactose (Ohmiya et al., 1977).

A new derivative with 20 α - and 20 β - reduction of steroids, as well as ability to destroy steroids, was demonstrated in *Bacillus megatherium* cells entrapped in gel (Koshcheyenko et al., 1976).

Cell immobilization may be associated with purely morphological changes. The immobilization process elicits changes in cell membranes of *Acetobacter suboxydans* and *Saccharomyces cerevisiae*, although transforming capacity of cells is retained (Kierstan, Bucke, 1977; Schnarr et al., 1977).

Incorporation of *Micrococcus lactis* cells in activated carboxymethylcellulose is associated with damage to the cell wall. However, micrococcal histidine ammonia-lyase activity was retained by more than 75% after transformation of 0.25 M L-histidine solution into uroconic acid (Jack, Zajic, 1977).

Information has been published concerning the potential of using immobilized microbial cells as catalysts of a number of processes (Vandamme, 1976). This author indicates that, at the present time, one can convert steroids, carbohydrates, amino acids and other compounds by means of immobilized cells. We shall cite several examples of using immobilized cells to recover a number of biologically active substances.

In the survey of Tibata Itiro and Tosa Tetsuya (1978), there is discussion of the results of studies dealing with the use of immobilized yeast and bacterial cells for large-scale production of biochemical reagents and biologically active substances. In addition to discussion of a number of problems related to immobilization of microorganism cells, there is a description of methods for obtaining immobilized *Escherichia coli* cultures capable of transforming fumarate into aspartate, and *Brevibacterium ammoniagenes*, which produce L-malate from fumarate.

Similar work was done by Sato et al. (1975). In their studies, *Escherichia coli* bacterial cells with high aspartase activity incorporated in PAAG catalyzed bonding of ammonia to fumaric acid with production of L-aspartic acid. There was description of continuous production of L-malic acid from fumaric acid by immobilized *Brevibacterium ammoniagenes* cells, which have high fumarase activity. It was noted that fumarase activity in immobilized cells decreased to only one-half after 52 days (Yamamoto et al., 1976, 1977; Abee, 1975).

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Escherichia coli cells with high penicillinamidase activity, which were immobilized in PAAG, were used for continuous production of 6-aminopenicillanic acid by means of hydrolysis of penicillin in a reactor of the column type.

Immobilization in PAAG of *Lactobacillus bulgaricus*, *Escherichia coli* and *Kluyveromyces lactis* cells, which have high β -galactosidase activity, was used for hydrolysis of lactose to monosaccharides (Ohmiya et al., 1977). The processes where immobilized cells are used to recover physiologically active substances can also be used for pharmaceutical purposes.

We shall give some examples of using immobilized cells in the food industry. *Saccharomyces cerevisiae* cells, which were immobilized in gel with calcium alginate, fermented soluble carbohydrates to ethanol for a long period of time (Bucke, Kierstan, 1977; Kierstan, Bucke, 1977). The same authors reported that chloroplasts entrapped in gel retained significant photosynthetic activity for a long time, and they can be used to develop systems of utilizing solar energy.

Partially purified preparation or whole *Streptococcus phaeochromogenes* cells with active glucose isomerase were used in a column reactor with glucose isomerase for continuous isomerization of glucose to fructose (Ryu et al., 1977). After appearance of information that it is possible to use fructose instead of beet and cane sugar to manufacture candy, the process of isomerization of glucose syrup to fructose by immobilized *Actinoplanes missouriensis* cells was used (Linko et al., 1977).

Immobilized *Corynebacterium glutamicum* cells synthesized glutamic acid (Slowinski, Charm, 1973). Immobilized *Lactobacillus casei* cells transformed malic acid to lactic acid (Divies, 1977). This is the main reaction in production of wines with low organic acid content.

Acetobacter suboxidans cells were immobilized in PAAG or treated with glutaric aldehyde. In both cases, the cells retained their capacity to oxidize alditols [?] (d-sorbitol, d-mannitol and others) (Schnarr et al., 1977).

At present, there are quite a few data on the use of immobilized cells for steroid transformation.

We found no information in the literature about biosynthesis of antibiotics by immobilized cells. However, we have demonstrated that immobilized *Streptococcus lactis* cells form the antibiotic, nisin, on a complex biosynthetic medium, but such cells form several times less antibiotic than free cells. To obtain nisin, immobilized cells can be reused with the same level of antibiotic activity. Biosynthesis of nisin by immobilized cells was observed at the optimum pH and temperature for growth and development of *Str. lactis* cultures. Biosynthesis of this antibiotic by immobilized *Str. lactis* cells does not depend on degree of aeration or stirring of the medium (Yegorov et al., 1978).

Thus, immobilized microorganism cells are capable of performing the most diverse transforming and biosynthetic processes. Cultivation of immobilized microorganisms, along with proper selection and preparation of the object and conditions of immobilization thereof, is another method of controlling microbiological processes. Investigation of physiological and biochemical bases of behavior of immobilized cells is a task for the future (Rabotnova, 1977).

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BIONICS

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BIOMECHANICS, BIONICS AND SYMMETRY

Moscow BIOMEKHANIKA, BIONIKA I SIMMETRIYA in Russian 1981 (signed to press 19 Mar 81)
pp 2-7, 238-239

[Annotation, introduction and table of contents from book "Biomechanics, Bionics and Symmetry", by Sergey Valentinovich Petukhov, Izdatel'stvo "Nauka", 1850 copies, 240 pages]

[Text] This book deals with symmetry phenomena in living nature and use of mathematical symmetry methods to model biological systems and phenomena. Special attention is given to conformal symmetries and Fibonacci numbers in biological bodies, particularly in the kinematic body schema of man and animals. It is noted that, from the standpoint of symmetry in solids, inanimate matter is a special case of animate substance. The book is intended for a wide range of scientists concerned with research in biomechanics, biophysics, mathematical and theoretical biology, and bionics.

Introduction

This book deals primarily with one of the ancient problems of life, the problem of symmetry of shape of biological bodies. In the terminology of V. I. Vernadskiy [42-44], who outlined the routes of studying, from the standpoint of mathematical natural science, of this biological problem, a key one in his opinion, it can be stated that the book explores symmetries of the space of living matter. The work is based on the idea of non-Euclidean nature of this space, the fundamental significance of non-Euclidean symmetries in structurization of living matter and non-Euclidean basis of laws of morphogenesis.

The results of the studies conducted by the author justify the use of the group of conformal (circular) symmetries as the fundamental group of symmetries of living matter in modeling the phenomena discussed. In the author's opinion, many of the mysteries of both formation of biological bodies and all of biology are referable to the conformal nature of the space of living matter. In this respect, the book submits data on symmetries and shapes of biological bodies. It is noted that the well-known symmetries of the Euclidean type in these bodies--mirror, rotatory, translation--are only special cases of conformal symmetry whose manifestations in biological forms are far from limited to these. The author believes that there is expression in living nature of the rather general principle of construction of biological bodies from conformally symmetrical blocks [units]. The book contains a verification of this hypothesis on a number of types of biological bodies, as to the specific crystallization principles of production of living matter.

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The described studies are closely related to the teaching, long since discussed in the literature, concerning generalized crystallography capable of covering the distinctions of structurization of not only physical, but biological matter. However, development of this teaching to date by J. Bernal and S. Carlyle [20] is based on the idea of Euclidean bases of general crystallography. The basic distinction of the approach discussed in our book to questions of structurization of living matter is the statement that this structurization is non-Euclidean and that it is necessary to construct generalized crystallography on a non-Euclidean (conformal) basis. From the standpoint of expressed symmetries, inanimate matter emerges as a special case of animate matter.

The motor system of man and highly organized animals is the focal biological object of the studies reported in our book. Numerous works by specialists in the most varied branches of natural science have dealt with organization of this system, since these problems are closely linked with a number of basic biological problems, as well as applied problems of ergonomics, prosthetics, sports and others. In particular, this system serves as the prototype of many bionic and robotic systems. The specific element in the research on the human and animal motor system discussed in this book is that the symmetrical correlations between its component blocks were studied. In this direction, many new and interesting findings were made concerning the patterns of organization and function of the motor system. One of the results was the discovery of conformal symmetries in the block structure of the kinematic body schema of man and a broad class of animals, in whom these symmetries exist, along with mirror symmetry of the body.

The book consists of five chapters and several appendices. Chapter 1 submits data on biological symmetries. Special attention is given to the link between biological symmetries and the series of Fibonacci numbers. General information is given about the fundamental significance of methods of symmetry and invariant-group conceptions in modern mathematical natural science for definition of the place of research on biological symmetries in the field of general natural science. An excursion is made to known teachings on biological symmetries and generalized crystallography which extend to living matter the geometrical and crystallographic approaches of theoretical physics.

Chapter 2 deals with investigation of conformal symmetries in biology. Data are submitted on conformal symmetries in the construction of various biological bodies. A special place is assigned to conformal symmetry in block principles of structure of the kinematic body schema of man and highly organized animals. It is noted that these symmetries, just like symmetries of the Euclidean type in biological bodies, are closely linked with a series of Fibonacci numbers and golden section, which are known in esthetics of proportions. The submitted data indicate that, with respect to its block distinctions, the kinematic organization of our body is much closer than usually believed to organization of the bodies of plants and even biological molecules, which have no kinematic function at all. This means that the kinematic body schema of man and animals is not constructed by all criteria of kinematic optimality by far, and it cannot be considered the ideal kinematic scheme that should be given to robots. And, if we are considering the kinematic organization of our body as a patent of living nature, in view of the fact that kinematic and static requirements were far from the only decisive conditions of its development, this is unlike the problem of developing a robot according to the criterion of kinematic optimality.

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In the same chapter, the distinctions of conformal geometry are tied in to problems of genesis of spatial conceptions of the individual, mysteries of geometry of the space of visual perception and problems of architectural bionics. Approaches are developed to problems of organization of motor movements with consideration of conformal symmetries in kinematic blocks of the human and animal body. The study of conformal symmetries in biology is accompanied by a brief summary of data on the significance of conformal symmetry in physics, in particular, data on conformal invariance of Maxwell's electrodynamic equations, which have drawn the attention of theoretical physicists again and again for many decades, to disclose its physical significance and consequences. The prospects of interrelated studies of problems of conformal symmetry in physics and biology is mentioned.

Chapter 3 submits data from an additional study of projective symmetries in biology, which was undertaken in the search for a fundamental group of spatial symmetries of living matter. This investigation was largely motivated by the fact that conformal and projective symmetries are mathematically interrelated, as well as the fact that one cannot rule out a priori the possibility of involvement of projective symmetries, along with conformal ones, in structurization of biological phenomena.

Chapter 4 deals with the application of invariant-group conceptions to the study of psychophysical phenomena. This branch of biology referred earlier than others to higher geometry as a source of ideas to interpret observed phenomena and as a rich arsenal of resources for formal modeling thereof. Attention is devoted here mainly to psychological phenomena of constancy of perception and geometric modeling of spaces of perception. Analysis is made of some examples of application to bionics of the results of studying biological symmetries.

The last, fifth chapter submits additional data on the use of symmetry methods in biomechanics. It deals with the use of invariant-group theory of dynamic likeness in modeling biomechanical systems and a life-sized physical model of the system of semicircular canals of the human vestibular system, which the author developed on the basis of this theory.

In conclusion, we should like to mention that the words of R. Feinman apply extremely well to the study of biological phenomena: "You will not find anything simple in nature, everything in it is mixed up and vague. Yet our inquisitiveness demands that we find simplicity, it demands that we pose questions, try to grasp the essence of things and comprehend their many faces as the possible result of effects of a relatively small number of elementary processes and forces in all sorts of combinations" [241, Vol 1, p 37]. It appears unquestionable that use of symmetry methods is invaluable for learning about biological phenomena, to find the substance and simplicity in these extremely complex class of natural phenomena. As G. Weil wrote, "symmetry--in the broad or narrow sense, depending on how you define the meaning of this concept--is the idea by means of which man has tried for centuries to achieve and create order, beauty and perfection" [40, p 37].

The author considers it his pleasant duty to express his profound appreciation to K. V. Frolov, corresponding member of the USSR Academy of Sciences, for his active support of this direction of research, comprehensive scientific and organizational assistance in this work. He takes this opportunity to also express his sincere gratitude to Prof V. S. Gurfinkel, who was the author's mentor for many years in the field of biomechanics and made a significant contribution to this book. Sincere

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Khar'kov PROBLEMY BIONIKI in Russian No 25, 1980 (signed to press 26 Dec 79)
pp 2, 123

[Annotation and table of contents from book "Problems of Bionics", Ukrainian Republic Interagency Scientific and Technical Collection, edited by Yu. P. Shabanov-Kushnarenko (editor in chief) et al., founded in 1968, Khar'kov Institute of Radioelectronics, Ukrainian Ministry of Higher and Secondary Specialized Education, "Vyshcha shkola" Publishing Association of Khar'kov State University, 1000 copies, 124+5 pages]

[Text] This collection deals with questions of mathematical modeling of processing of verbal and sensory information, development of software designed to give a formal description of functions of human intelligence. The possibility of technical rendition of sensory models and neuron-like information translators is explored. It is intended for scientists and specialists in the field of bionics, cybernetics and computer technology, engineering psychology, biology and medicine. There are bibliographies at the end of the articles. [author abstracts are provided].

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Khar'kov PROBLEMY BIONIKI in Russian No 24, 1980 (signed to press 19 Nov 79)
pp 2, 123

[Annotation and table of contents from book "Problems of Bionics", Ukrainian Republic Interagency Scientific and Technical Collection, edited by Yu. P. Shabanov-Kushnarenko (editor in chief) et al., founded in 1968, Khar'kov Institute of Radioelectronics, Ukrainian Ministry of Higher and Secondary Specialized Education, "Vyshcha shkola" Publishing Association of Khar'kov State University, 1000 copies, 123+5 pages]

[Text] In this collection there is discussion of hardware and software for modeling information processing on different levels of the nervous system. Models and methods of studying intellectual activity are discussed; the authors deal with problems of verbal information processing, pattern recognition and construction of specialized computer systems. It is intended for scientists and specialists in cybernetics, computer technology, engineering psychology and medicine. There are bibliographies at the end of the articles [author abstracts are provided]

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Khar'kov PROBLEMY BIONIKI in Russian No 23, 1979 (signed to press 20 Apr 79)
pp 2, 120

[Annotation and table of contents from book "Problems of Bionics", Ukrainian Republic Interagency Scientific and Technical Collection, edited by Yu. P. Shabanov-Kushnarenko (editor in chief) et al., founded in 1968, Khar'kov Institute of Radioelectronics, Ukrainian Ministry of Higher and Secondary Specialized Education, "Vyshcha Shkola" Publishing Association of Khar'kov State University, 1000 copies, 124+4 pages]

[Text] This collection submits the results of bionic research on information processing in sensory channels and neuronal structures. There is discussion of some aspects of intellectual activity, means of formal description of such activity and means of reproducing it in artificial reflection and control systems. The authors touch upon formalization and explication [explanation] of natural language concepts, and an approach is described for mathematical modeling of verbal information processing. There is development of software (mathematics and data) suitable for modeling and computer simulation of human mental functions. It is intended for scientists and specialists involved in bionic research with the use of the ways and means of cybernetics and computer technology. There are bibliographies at the end of the articles. [author abstracts are provided]

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Khar'kov PROBLEMY BIONIKI in Russian No 22, 1979 (signed to press 22 Feb 79) pp 2, 142

[Annotation and table of contents from "Problems of Bionics", Ukrainian Republic Interagency Scientific and Technical Collection, edited by Yu. P. Shabanov-Kushnarenko (editor in chief) et al., founded in 1968, Khar'kov Institute of Radioelectronics, Ukrainian Ministry of Higher and Secondary Specialized Education, "Vyshcha Shkola" Publishing Association of Khar'kov State University, 1000 copies, 142+3 pages]

[Text] This collection deals with bionic research and mathematical description of various aspects of man's intellectual activity. It discusses the principles involved in construction of special computer systems, their software [mathematics and data] suitable for modeling and computer simulation of algorithms for data processing in man's sensorium. Studies were made of the possibility of mathematically describing thinking processes and processing of verbal information by man. It is intended for scientists and specialists concerned with bionic research with the use of the ways and means of cybernetics and computer technology. There are bibliographies at the end of the articles [author abstracts are provided].

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ENVIRONMENT

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DYNAMICS OF ECOLOGICAL-ECONOMIC SYSTEMS

Novosibirsk DINAMIKA EKOLOGO-EKONOMICHESEKIKH SISTEM in Russian 1981 pp 2-5

[Annotation, part of foreword and table of contents from book "Dynamics of Ecological-Economic Systems", edited by L. M. Galkin, candidate of physical and mathematical sciences, A. I. Moskalenko, candidate of physical and mathematical sciences, and V. V. Kontorin, East Siberian Branch, Siberian Department of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 219+ pages]

[Text] This monograph is concerned with mathematical models that describe the dynamics of individual populations and processes in the marine environment, forest biogeocenoses and certain complex ecological ["natural"] and ecological-economic systems. The economic models direct themselves to regional problems; they take into consideration depletable resources and deleterious effects on the environment. Questions of using secondary raw material and industrial waste occupy a special place in this monograph. The book is intended for mathematicians working in the field of modeling and research on ecological-economic systems, as well as geographers, hydrologists, ichthyologists and economists.

Foreword

At the present time, questions related to the dynamics of ecological-economic systems are advancing to the fore in view of the increasing impairment of ecological equilibrium of the environment as a result of industrious activities. The complexity of ecological and economic systems, let alone of combined ecological-economic, makes it imperative to search for the means of quantitative analysis of their behavior as related to a given strategy of anthropogenic activity. It is now generally recognized that one should use mathematical modeling for this purpose.

Ecological-economic processes are comprised of diverse processes in the natural environment (biological, physical, mechanical, etc.), economics and social area. Studies that are united by the topic of modeling these processes are referable to many concrete disciplines and directions, ranging from special mathematical forecasting and control methods to modeling of the different processes in biology and economics.

This monograph deals with ecological-economic models constructed for forecasting and decision making purposes. As a rule, the research is focused on one of the topics--ecological or economic. In the ecological studies, the controlling factors or criteria of behavior are economic in nature, while economic systems are examined with consideration of the dynamics of resources and factors affecting nature. As

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a rule, differential equations (ordinary and in partial derivatives) and discrete analogues thereof serve as the working mathematical system. Concrete models described in this book are related primarily to problems referable to Lake Baykal and its basin; however, by virtue of the universality of mathematical models, they can be used for rather different regions. This monograph is the third in a series of works of the Commission on Long-Term Forecasts of Natural Phenomena under the Presidium of the East Siberian Branch of the Siberian Department of the USSR Academy of Sciences, dealing with questions of mathematical modeling of processes in the environment and economics....

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MEDICINE

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MATHEMATICAL MODELS OF DISEASES AND METHODS OF PROCESSING MEDICAL INFORMATION

Novosibirsk MATEMATICHESKIYE MODELI ZABOLEVANIY I METODY OBRABOTKI MEDITSINSKOY INFORMATSII in Russian 1979 (signed to press 25 Apr 79) pp 2-4, ...

[Annotation, foreword by Academician G. I. Marchuk and table of contents from book "Mathematical Models of Diseases and Methods of Processing Medical Information", edited by Guriy Ivanovich Marchuk, Izdatel'stvo "Nauka", Sibirskoye otdeleniye, Computer Center of the Siberian Department of the USSR Academy of Sciences, 1850 copies, 103+ pages]

[Text] This book deals with problems of mathematical modeling of disease processes, description of the main principles and distinctions of biochemical and immune processes, methods of processing clinical and laboratory data, as well as use thereof in clinical practice. It is intended for a wide range of mathematicians and physicians concerned with applications of mathematics to immunology and medicine.

Foreword

In recent years, mathematical modeling and computer methods are being introduced intensively in medicine and modern immunology. The intensive development of immunology in the last decade has resulted in formation of the entire picture of the immunological response of living organisms to antigen (Burnet's clone and breeding theory,* the work of R. V. Petrov**). This has deepened our understanding of the nature and development of viral diseases, enriched with new agents the area of clinical medicine, made it possible to develop mathematical models of immunological processes and to further develop mathematical methods of processing clinical and laboratory data. To conduct studies in these directions, there must be close contact between mathematicians, physicians, immunologists, biochemists and other specialists.

The articles in this collection submit the main results of joint research conducted by the staff of the Computer Center, Siberian Branch of the USSR Academy of Sciences, physicians in the department of childhood infectious disease at the Second Moscow "Order of Lenin" State Medical Institute (2 MOLGMI) imeni N. I. Pirogov, as well as the staff of the Institute of Cytology and Genetics, Siberian Branch of the USSR Academy of Sciences.

*Burnet, F., "Cellular Immunology," Moscow, "Mir", 1971, 542 pages.

**Petrov, R. V., "Immunology and Immunogenetics," Moscow, "Meditsina", 1976, 330 pages.

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These findings have been the subject of repeated discussion at joint scientific seminars and conferences. Such research was begun in the Siberian Department of the USSR Academy of Sciences about 5 years ago, and the first results were published in 1978.*

Methodologically, the contents of this collection can be divided into three sections. The first consists of articles dealing with mathematical modeling of immunological processes (articles by G. I. Marchuk, L. N. Belykh, A. L. Asachenkov); the second section consists of works dealing with validation of mathematical methods of processing clinical and laboratory data, and applications thereof in clinical practice. The principal results of joint work done by the Computer Center of the Siberian Department of the USSR Academy of Sciences and 2 MOLGMI pertaining to development of mathematical methods of processing clinical and laboratory data referable to viral hepatitis in children were submitted in an article by a team of authors (N. I. Nisevich, academician of the USSR Academy of Medical Sciences, I. I. Zubikova, I. B. Pogozhev et al.). The articles by I. B. Pogozhev, S. M. Zuyev and N. V. Pertsev deal with mathematical modeling of the process of functional recovery from diseases, investigation of stochastic stability of these processes, as well as methods of estimating parameters from clinical and laboratory data. The third section consists of articles describing the chief principles and distinctions of biochemical and immunological processes, which must be taken into consideration in constructing mathematical models (articles by D. G. Knorre, corresponding member of the USSR Academy of Sciences, V. V. Vlasov, Ye. V. Gruntenko).

It is to be hoped that this collection will be useful to mathematicians, immunologists and physicians concerned with applications of mathematics to problems of immunology and medicine.

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*"Mathematical Methods in Clinical Practice." Novosibirsk, "Nauka", 1978, 120 pages.

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Some Distinctions of Antineoplastic Immunity Relevant to the
Construction of Mathematical Models (Ye. V. Gruntenko)

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PHYSIOLOGY

UDC: 681.3:612.172.4

COMPUTERIZED ELECTROCARDIOGRAPHY

Moscow VYCHISLITEL'NAYA ELEKTROKARDIOGRAFIYA in Russian 1981 (signed to press 8 Jan 81) pp 2-4, 165-167

[Annotation, foreword by Prof I. Sh. Pinsker, preface and table of contents from book "Computerized Electrocardiography", by Vsevolod Vladimirovich Shakin, Izdatel'stvo "Nauka", 2000 copies, 168 pages]

[Text] This book is concerned with mathematical models and their numerical expressions that are used for automated processing of data about the heart's electric field. There is discussion of methods of computer simulation of the actions of an electrocardiologist in interpreting EKG's. The means of upgrading EKG diagnostics are described, which ensue from computer interpretation of cardiograms with the use of statistical methods and biophysical data on the genesis of the EKG. Much attention is devoted to problems of developing automated systems of EKG diagnostics. An automated network system of remote cardiological diagnostics based on a small computer with many medical subscriber points (terminals) is described. This book is intended for specialists in biological and medical cybernetics, physician-electrocardiologists, as well as undergraduate and graduate students in relevant fields. Illustrations 70; references 147.

Foreword

The first automatic systems for recording, analyzing and storing electrocardiograms appeared more than 15 years ago. In subsequent years, intensive research was conducted and knowhow was gained in the use of such systems. However, there had not been a single monograph summarizing this research in this country until now. Let us mention that many questions that arise in developing a system require the collaboration of physicians, biologists, physicists, engineers and mathematicians to find the answers. This monograph is an attempt at finding a common language among different specialists in solving some of these problems. The material in this book is presented at the so-called physical level of accuracy ["strictness"].

When scrutinizing the monograph for the first time, one can disregard the mathematical conclusions and concentrate on the final statements and comments to them.

This book reflects the current status of problems that arise when processing electrocardiograms on modern computers---recording, transmitting, converting [translating], storing and interpreting electrocardiograms and other data about a patient. There is discussion of algorithms for preliminary processing of electrocardiographic signals (filtration, compression for more efficient transmission of

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electrocardiographic signals and to be economical with the memory of storage units), as well as parameterization of electrocardiograms, algorithm of syndrome diagnostics from the EKG and clinical diagnostics on the basis of electrocardiograms and other data about the patient.

The algorithms are rendered in the form of a package of applied programs in the system of special software for the automated SAS-1 system, which was developed within the framework of collaboration between the USSR Academy of Sciences and Hungarian Academy of Sciences, on the basis of a small, third-generation computer included in the Unified Series of computers of socialist countries. The hardware and software of this system is described, and this is addressed primarily to readers who plan to make creative use of the SAS-1 and future similar equipment in their research, as well as developers of such systems. In addition to the existing versions of the system, which is applicable, for example, for mass screening of the public to pick up cardiological patients, there is discussion of the possibility of designing more sophisticated modifications of the system of computerized interpretation of electrocardiograms. Traditional medical knowhow is being constantly enriched by the concepts of modern biophysics of the heart. Special statistical models and methods of processing electrocardiograms are being developed. For this reason, there is every reason to believe that systems will soon appear that are even more sophisticated than the SAS-1. This book will be useful to developers and users of such systems.

Preface

In view of the importance, considerable size and diversity of the bibliography, the author deemed it expedient to provide bibliographic notes about all references, and they follow each major section of the book.

The mathematical expressions and formulas are numbered in order within each chapter, while the illustrations are numbered in order throughout the book. These numbers are used for references within chapters. When a reference is made in the text of one chapter to formulas given in another, the number of the latter is also used. For example, (1.6) refers to formula 6 given in Chapter 1.

It is the author's pleasant duty to thank the staff of the Institute of Problems of Information Transmission of the USSR Academy of Sciences in Moscow (IPPI) and Scientific Research Institute of Communications of the Hungarian People's Republic (TKI) where most of the original work described here was performed and this book was written, as well as to express appreciation to all colleagues who stimulated this study with their comments.

The author is very grateful to the scientific reviewers: V. D. Zhukovskiy, doctor of medical sciences, professor at the First Moscow Medical Institute, and V. S. Fayn, candidate of engineering sciences, senior scientist at IPPI.

The author wishes to particularly thank Prof I. Sh. Pinsker (IPPI) who took on the job of scientific editing and wrote the foreword to this book, engineer Cs. Csapodi (TKI) who prepared a significant part of the material on the SAS-1 system, Dr Istvan Preda (Institute for Advanced Training of Physicians, Hungarian People's Republic) and engineer Gy Kozmann (Central Institute of Physical Research,

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Hungarian Academy of Sciences) who collaborated in the study of the heart's electro-mechanical field, as well as programmer Kataline Hajdu (TKI) and engineer N. Ye. Barinova (IPPI) for their great technical assistance.

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SIMPLE METHOD OF NUMERICAL EVALUATION OF HUMAN EEG POTENTIALS

Moscow BIOFIZIKA in Russian Vol 26, No 5, Sep-Oct 81 (manuscript received 23 Sep 80)
pp 894-896

[Article by A. Shimolyunas, Institute of Mathematics and Cybernetics, LiSSR
Academy of Sciences, Vilnius]

[Text] It is known that it is important to take into consideration the spasmodic changes in conduction of the numerous tegmenta of the brain [1] in simulating the genesis of human EEG potentials with given intracranial sources. This, as well as the virtually spherical shape of the human skull [2], is why different variants of the model of a multilayer spherical cable are used in digital construction of the EEG. The sought solutions, within the framework of these models, are given in the form of sum of Legendre polynomials taken with specific weights. For example EEG potential U_1 from a radial dipole is calculated with the following formula [3, 4]:

$$U_1 \sim \sum_l c(l) P_l \quad (1)$$

where P_l is a Legendre polynomial of the l th degree, $c(l)$ are weight coefficients that depend on the means of modeling the tegmenta of the human brain.

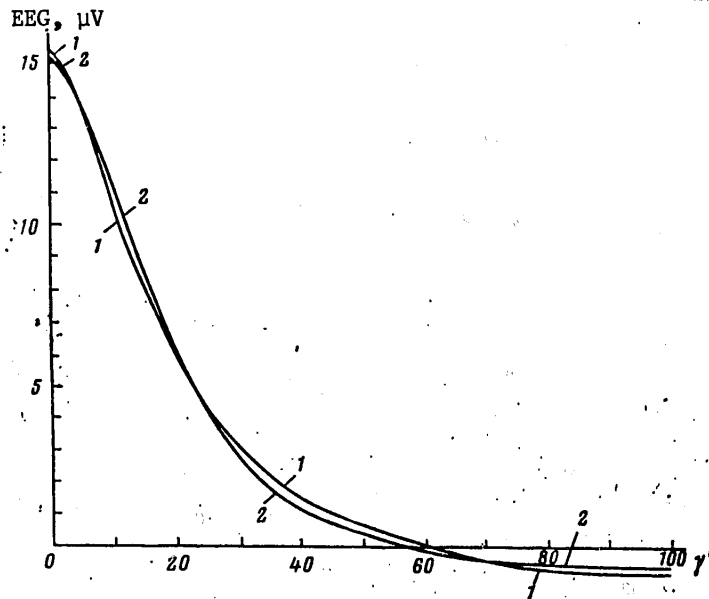
Evidently, it is possible to calculate EEG potentials using formulas of the (1) type only on a digital computer, and this makes it difficult for practical use of digital analysis of the human EEG in electroencephalographic practice.

We previously demonstrated [5] that the role of the tegmenta of the human brain in genesis of the EEG with given intracranial sources can be simulated with an unrealistically thick (~4 cm) layer of electrolyte over the surface of the cerebral cortex described by a sphere with radius $r_0 = 8$ cm, i.e., radius r_g of the isolated surface equals 12 cm. This simulation of the cerebral tegmenta, which does not conform to the real physics of the problem of genesis of the human EEG, does, however, offer the tempting possibility of using simple analytical versions of a model of a homogeneous isolated sphere [6] for digital evaluation of EEG potentials. For example, potential U_1^* on the isolated surface of radius r_g from the radial dipole situated on radius r_d can be calculated in this model, when the angle between these radii equals γ , with the following formula:

$$U_1^*(r_g, r_d, \gamma) \sim \frac{1 - f^3}{(1 + f^3 - 2f \cos \gamma)^{1/2}} - 1, \quad (2)$$

where $f = r_d/r_g$.

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Human EEG potential calculated in a model of a multilayer spherical cable [1, 3] (curve 1) and with the simulation formula (3) (curve 2)

U_1^* will describe the human EEG potential if $r_d \leq 8$ cm and $r_g = 12$ cm, i.e., $f \leq 0.67$. Calculation of EEG potentials with formula (2) no longer presents any difficulty, and it can be easily done with desk calculators.

Let us consider in more detail the particularly interesting case of a cortical dipole ($r_d = 8$ cm), $D = 1/4\pi$ mV·cm², which corresponds to the transcortical difference in potentials equaling 1 mV over an area of 1 cm². A point dipole can be well-used to represent cortical dual layers with area $S \leq \pi$ cm² [3]. Comparing EEG potentials calculated within the framework of an adequate model of multilayer spherical cable with thin layers [3] to the EEG potential calculated with $f = 8/12$ according to formula (2), we see that they coincide well (Figure) and, after algebraic conversions of formula (2) we obtain the following elementary simulation formula (EEG in μV from transcortical potential of 1 mV over 1 cm² of cortical area):

$$U_1(\gamma) = (2.018 - 1.863 \cos \gamma)^{-1.5} - 1.09. \quad (3)$$

We have discussed a simple numerical simulation of EEG potential of a radial dipole. A relatively simple formula (17) was obtained with the model of homogeneous isolated sphere in [6], used to calculate the potential of an arbitrary dipole, and formula (2) is a special case thereof. Thus, the proposed simulation ($r_g = 12$ cm, $r_d \leq 8$ cm) also makes it possible to readily calculate the EEG potential from both tangential cortical and arbitrarily oriented subcortical dipoles.

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BOOK ON FORECASTING BORDERLINE CONDITIONS REVIEWED

Moscow USPEKHI FIZIOLOGICHESKIH NAUK in Russian Vol 12, No 3, Jul-Sep 81 (signed to press 11 Jun 81) pp 141-142

[Review by K. M. Smirnov of book "Prognozirovaniya sostoyaniy na grani normy i patologii" [Forecasting Conditions on the Borderline Between Normal and Pathology] by R. M. Bayevskiy, Izdatel'stvo 'Mir', Moscow, 1979, 295 pages]

[Text] Predicting man's condition under specific living conditions has constantly drawn the attention of physiologists and physicians. This explains the interest of the book under consideration. The author, a physiologist who has been working on methods of forecasting human states for several years, offers to the reader a survey of the literature and the results of his own research directed at predicting disturbances of the physiological norm under different conditions of human endeavor.

The first two chapters discuss the theoretical bases of forecasting as it applies to evaluation of man's health. Some of the cited theses taken from the literature are debatable and contradictory. Generally speaking, this is not bad, since it shows different aspects of the problem in question. At the same time, the author's point of view should, perhaps, have been more clearly formulated with regard to some issues. Thus, with reference to the transition from health to disease, the book cites several opinions on the gradual nature of this transition, interpenetration of these states and, at the same time, the thesis is formulated that there exists an intermediate, "third" state, which is no longer health and not yet sickness, designated as a "state of tension," "unstable adaptation" or "prenosological state." As a result, formulation in the title of the book of the "borderline between normal and pathology" becomes somewhat vague and indistinct as the object of prediction.

Some of the definitions used in the book could also be questioned. For example, adaptation is defined only as protective reactions against factors that become deleterious if the body's adaptability is inadequate. Evidently, this formulation requires better definition. For adaptation not only prevents disruption of the normal, with regard to many factors, but within certain limits it also alters the range of normal reactions, i.e., it alters the health level. Some degree of adaptation is necessary to achieve the optimum state. These and certain other unclear elements in the text could hardly be considered only as a flaw. They cause the reader to think and ponder over issues, for which there is still no generally recognized opinion.

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Presentation of the author's own data is preceded by a chapter dealing with methods of predicting states. It is suggested that, in such an evaluation, one single out the levels of functioning of physiological systems, degree of tension of regulatory mechanisms and functional reserves. Primarily the function of the circulatory system is discussed as a parameter characterizing the level of body function. It is suggested that ballistocardiography and seismocardiography are expedient methods for examining large groups of healthy (or essentially healthy) people. Two approaches are used to determine the degree of strain on regulatory mechanisms: mathematical analysis of heart rate and assay of sodium:potassium ratio in saliva. Depending on the purpose of the studies, the heart rate is evaluated either solely according to distinctions of statistical distribution of duration of cardiac cycles, or also according to the results of correlation and spectral analysis of sequences thereof in a time series. According to the author's experience, the results of ballistocardiography and seismocardiography also furnish material for making a judgment about functional reserves.

It is recommended that changes occurring over a 24-h period are an effective approach to assess the state of the entire organism. Two simplified parameters are proposed to characterize the daily dynamics of a given subject: the parameter of 24-h adaptability and coefficient of synchronization of functions. The former is the ratio of difference in values of the measured parameter of the state of the organism at 0700 and 1100 hours to the value of this parameter at 0700 h; the latter refers to the coefficients of correlation between different parameters calculated for different times of day and as the mean over a 24-h period.

The next chapters submit the results of the extensive research conducted by the author and his colleagues. The listed methods and a number of other physiological techniques were used in laboratory experiments for the study of hypokinesia, prolonged sleep deprivation, activity simulating operator work, as well as under the ordinary conditions of work and sports activity. The author validly believes that the demonstrated signs of strain could be of prognostic value to determine the possibility of disruption of the norm with further increase in intensity and duration of loads. At the same time, after scrutinizing the data submitted in this book, it remains unclear as to whether the demonstrated levels of tension necessarily indicate onset of pathology if the load is increased. There are few confirmations of such prognostic value of the levels of parameters studied, and the submitted data have such meaning apparently in only the concrete cases discussed. Moreover, in the discussion of factual data, consideration is not given to the fact that a certain level of tension in routine activity is a mandatory prerequisite for optimum existence and complete health of man.

The last chapter is of great interest; it reports on the experience of mass screenings conducted for the detection of prenosological states. A fortunate combination of physiological and medical approaches in the screening program made it possible to assess the health status of large groups--blue and white collar workers of entire enterprises. The results of such studies not only are of theoretical interest, but can be used for working out specific preventive measures.

The author's tendency to place all of the complicated factors he describes into prepared charts characterizing the structure and functions of the human body, as well as a penchant for concepts and terms of cybernetics and regulation theory, constitute a certain deterrent to the reading of the book. However, such

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uniqueness of the presentation by no means minimizes the interest of the work in question or its significance. The extensive factual material submitted by the author, as well as the vast literature on the subject, are instructive and useful to a wide range of specialists working on applied human physiology and many branches of medicine. No doubt, anyone who has to work with or is interested in the problem of predicting health disturbances in man under different living and working conditions will refer to the book by R. M. Bayevskiy.

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RATE OF HEXENAL DETOXIFICATION AND INDUCTION OF THIS PROCESS IN RATS RAISED
UNDER CONDITIONS OF MUSCULAR LOADS

Leningrad ZHURNAL EVOLYUTSIONNOY BIOKHIMII I FIZIOLOGII in Russian Vol 27, No 3,
May-Jun 81 p 332

[Abstract of article by V. D. Rozanova, Scientific Research Institute of Normal
Physiology imeni P. K. Anokhin, USSR Academy of Medical Sciences, Moscow, filed
with the All-Union Scientific Research Institute of Scientific and Technical
Information, 1980, 9 pages]

[Text] In view of data to the effect that muscular loads of the physiological
stress type enhance nonspecific resistance, as well as the fact that glucocorti-
coids stimulate the activity of microsomal enzymes of the liver, which metabolize
xenobiotics, a study was made of the effect of muscular loads used in the course
of development of rats of both sexes between the 1st and 5th-6th months. It was
demonstrated that there is briefer duration of hexenal detoxification (DHD) in
experimental rats and increased induction of this process by small doses of pheno-
barbital (1, 10 and 20 mg/kg). The hypothesis is expounded, on the basis of
increased mass, relative weight of the adrenals and their cortical layer in rats
developing with the use of muscle loads, that the inductive effect of muscular
burdens occurs through activation of the hypophyseohypothalamic neurosecretory
system. This influence is more marked in experimental females than males, since
females normally present less motor activity. Moreover, it was demonstrated that
there is an 18% increase in phospholipid content and 10% increase in protein
content in the liver of experimental females. This, as well as the greater
shortening of DHD, are indicative of increased synthesis of microsomal enzymes in
the hepatic endoplasmic reticulum due to masculinization of females and the
increased activating effect of androgens.

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ALL-UNION SYMPOSIUM ON 'SELF-REGULATION OF FUNCTIONS AND STATES'

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I. M. SECHENOVA in Russian Vol 67, No 6, Jun 81 (manuscript received 29 Dec 80) pp 931-933

[Article by N. N. Vasilevskiy]

[Text] A symposium convened in Leningrad on 2-3 October 1980, which dealt with the problem of self-regulation of functions and states; it was organized by the Academy of Medical Sciences and Scientific Research Institute of Experimental Medicine, USSR Academy of Medical Sciences. Prominent physiologists, pathophysiologicalists and clinicians from 18 cities of our country (Moscow, Leningrad, Novosibirsk, Riga, Vilnius, Alma-Ata, Tbilisi, Yerevan, Karaganda and others), representing 32 scientific and scientific-practical institutions, participated in the symposium. Four problems were discussed at the symposium: neurophysiological mechanisms of somatic and visceral systems, evolution and ontogenesis of self-regulation of functions and states, self-regulation of functions during adaptation of man and methods of adaptive biocontrol in clinical practice.

In his paper, V. N. Chernigovskiy stressed the fact that one of the universal mechanisms of self-regulation of functions is habituation. He demonstrated the link between habituation and processes of reactive inhibition in nerve cells to which afferent signals are repeatedly directed. The speaker discussed a hypothesis, according to which the dynamics of excitatory and inhibitory processes conform with the principle of Le Chatelier.

In recent years, convincing data have been accumulated concerning the importance of biorhythms in mechanisms of homeostasis and adaptation. Some new data were reported on combinatory patterns in time and space organization of EEG rhythms of man during adaptation to the extreme conditions of Antarctica; individual variations were demonstrated in stable associations between different components of EEG rhythm (S. I. Soroko, S. S. Bekshayev, V. B. Kutuyev). Cyclically recurring combinations of EEG rhythm components in man and animals were discovered, which reflect differentially various functional states (N. N. Vasilevskiy, N. B. Suvorov, V. V. Ur'yash, G. V. Kukhtina).

In the paper of V. A. Matyukhin, analysis was made of the effects of biorhythmological and climate factors on man. It was shown that a state of chronophysiological tension, which leads to so-called circadian and seasonal desynchronosis, develops when one crosses the time zones. Suggestions were advanced for setting standards of chronophysiological burdens and climate contrast for pilots and individuals working on a periodic schedule.

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A series of papers dealt with the distinctions of cardiac rhythm under normal and pathological conditions. D. I. Zhemaytite distinguished two extreme variants of functional state of the heart, which are characterized by stabilization of sinus rhythm at rest and with maximum burden, respectively. When there is prevalence of parasympathetic influences, respiratory arrhythmia is a typical finding; with increase in sympathetic influences slower fluctuations of heart rate appear. A classification was proposed for rhythmograms, as well as algorithms for automatic analysis thereof, the results of which could be used as prognostic criteria for athletes and patients with ischemic heart disease (Yu. I. Brozhaytene, A. B. Zhukauskas, A. K. Kepezhenas, G. A. Varonetskias).

In extreme situations and with nociceptive stimuli, there is development, as demonstrated by V. S. Khrapov, of disorders referable to the cardiovascular system and energy supply to the myocardium. Blocking of the adrenergic system prevents [or eliminates] edema and swelling of the brain.

N. I. Moiseyeva, V. M. Doronicheva, V. M. Akhutina, A. I. Monakhov and others called attention to analysis of variable parameters in evaluating man's condition. The marked time structure of circadian biorhythms of parameters of functions, relatively high average values, constancy of maximum and minimum, and others are indicators of a stable normal state of the human body.

Low-frequency components of biorhythms in the second and decasecond ranges for the EEG, so-called quasistable differences in brain potential, cardiac rhythm and others play an important role in processes of adaptive self-regulation of states (V. A. Ilyukhina, Ye. G. Vashchillo, N. K. Stepanov, K. F. Peskovskiy and others). This made it possible to advance the conception of adaptogenic rhythms (N. N. Vasilevskiy), by means of which, as demonstrated by Z. A. Aleksanyan and I. M. Kiselev, intersystem interaction of functions during adaptation and learning is provided.

As reported by P. I. Gumener, correlations between fluctuations of heart rate frequency and parameters of EEG rhythms in the range of 0.1-0.01 Hz are observed with functional and information loads. In the paper of D. N. Menitskiy, A. M. Zingerman and M. M. Kozlovskaya, they submitted the results of a study of the mechanisms of voluntary regulation of heart rate, demonstrating individual differences and the possibility of modulation thereof from 50 to 120 beats/min in the presence of variable psychoemotional tension, which makes it possible to superimpose specified sinusoids (0.01-0.15 Hz) with the frequency envelope of cardiac rhythm under visual monitoring.

Formulation of the principle of continuous development and biorhythmological control of memory, which explains satisfactorily the distinctions of readaptation and repeated adaptation, the discreteness of arrays of information in memory and many of its properties related to providing for stable states and distinctions of reproducing them prompted animated discussion (N. N. Vasilevskiy). G. A. Vartanyan, Ye. I. Varlinskaya and S. P. Shklyaruk submitted data on neurochemical (peptide) regulation of stable states in the presence of brain lesions, and demonstrated that it is possible to transfer them by means of injection of spinal fluid (or peptide fractions) to intact animals. Yu. P. Gichev reported that, in the case of adaptation to climate, changes in the reaction of lipid peroxidation combined with evaluation of antioxidant activity and concentration of blood cholesterol could serve as useful prognostic indicators of adaptation.

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At the symposium, there was also discussion of questions of ontogenesis of biorhythmological characteristics of functions and states. There was demonstration of the distinctions of rhythms of behavior, EEG, EMG, respiration and neuronal activity. A. V. Voyno-Yasenetskiy stressed the leading role of autorhythmic mechanisms at the early stages of ontogenesis in regulation of behavior and physiological rhythms. In the course of phylogenesis, as in ontogenesis, there is a change from period, autorhythmic bursts of activity to continuous rhythmic processes. Under adverse conditions, one observes a return to periodic bursts of activity. O. V. Bogdanov demonstrated that there is directional change in motor functions, EMG and neuronal activity from the 18th day of embryogenesis in chickens, against the background of synchronization of EEG of different structures of the brain and a shift to the low-frequency range. I. G. Dik and Ye. L. Mikhaylenok located synchronizing mechanisms in the nuclei of the archistriatum.

V. V. Petelina studied the distinctions of formation of skill in controlling prostheses in disabled children of different ages. I. I. Yevsyukov and V. M. Sysuyev studied respiratory biorhythms of children of different ages under normal and pathological conditions. The stability of biorhythm structure is related to age and severity of illness. Yu. M. Pratusovich submitted data on factor and discriminant analysis of the EEG of school children, demonstrating individual differences in time and space distribution of EEG components and changes therein at different periods of the school year, and related them to development of supraliminal inhibition.

There was broad coverage of the results of studies dealing with directional modification and states by the method of adaptive biocontrol, which could be viewed as instrumental methods of autotraining. In his paper, N. V. Chernigovskiy reported on the use of these methods in neurology for patients with neuroses, epilepsy and arachnoiditis. Determination was made of the factors that provide for maximum efficacy: maximum approximation of the type of biocontrol to the clinical distinctions of the disease, consideration of the functional state and psychophysiological status of the patient. I. A. Svyatogor, S. A. Movsisyants, D. A. Stafilova, Ch. Chohanov and Ye. A. Kaydanova submitted the results of analysis of evoked potentials, EEG and other functions with biocontrol of EEG and galvanic skin response. Destabilization of pathological slow activity served as a positive prognostic element. A. N. Timofeyeva, V. T. Markman, A. N. Avsarkisyan and A. A. Vereshchagina reported the results of comparative analysis of voluntary control of the EEG by neurasthenic patients, as well as in combination with the EMG, galvanic skin response and simple motor reaction time.

Some of the papers dealt with pharmacological control of functions and states of the brain and visceral systems (A. V. Val'dman, A. M. Zingerman, M. M. Kozlovskaya, A. V. Martynikhin, I. S. Morozov and others). The opinion was expressed that there are apparently different neurochemical bases for activating and tranquilizing effects. The influence of tranquilizers is different on effects of psychoemotional tension. If it is associated with improved quality of a subject's performance, the tranquilizer improves performance, lowering the tonic effect of stress. Conversely, tranquilizers improve performance if it was diminished in the presence of stress.

In the discussions of the main and display papers, it was stressed that new and original experimental, clinicophysiological and clinical data were reported at this symposium, which deepen current conceptions of nervous, neurohumoral and metabolic

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mechanisms of self-regulation of functions. The symposium demonstrated the promise of complex analysis of hierarchically related mechanisms of self-regulation of functions and states.

It was also stressed at the symposium that it would be beneficial to organize, in the future, special discussions of neurophysiological mechanisms of adaptive regulation of the state of the nervous and visceral systems, as well as of functional methods of rehabilitation in sports and clinical practice, as one of the promising means of linking physiology with practice.

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ULTRAWEAK RADIATION IN INTERCELLULAR INTERACTION

Novosibirsk SVERKHS LABYYE IZLUCHENIYA V MEZHKLETOCHNYKH VZAIMODEYSTVIYAKH in Russian 1981 (signed to press 25 Feb 81) pp 2-4, 122

[Annotation, foreword and table of contents from book "Ultraweak Radiation in Intercellular Interaction", by Vlail' Petrovich Kaznacheyev and Lyudmila Pavlovna Mikhaylova, Izdatel'stvo "Nauka", 2800 copies, 122 pages]

[Text] This monograph deals with the conception of informational intercellular interactions within the electromagnetic communication channel. Experimental data are submitted on the biological significance of the cell's ultraweak radiation due to the extreme effects of biological, chemical and physical agents in remote intercellular interactions. A description is offered of a set of methodological approaches to recording ultraweak cellular radiation during remote intercellular interactions and its prognostic evaluation. There is demonstration of the prospects of using this source of valuable information about the physiological state of cells, integrity and impairment of their structures. This book is intended for specialists in biophysics, biology and biochemistry. Tables 35, figures 55, references 260.

Foreword

Modern biology has made considerable strides in learning about the diverse manifestations of living things, basic foundations, general patterns of organization and evolution of life on earth. Continued progress in the science that deals with life requires not only increasing depth of penetration into the essence of processes of interaction between matter and energy, but investigation of informative interactions in biological systems. The founder of this new direction of investigation of the properties of living systems, A. G. Gurvich, demonstrated that it is possible for information to be transmitted from one cell to another by the photons of an electromagnetic field, and he expounded the hypothesis that there are fields in living systems, which he named "biological" fields. Unfortunately, this direction is not being developed intensively enough in our times. At the present time, problems of transmission of biological information, recording and storing it in both cells and between cells and organs are acquiring first and foremost importance. It is impossible to attribute control of certain metabolic and trophic processes, which prevail both within cells and in the entire animal and human body, solely to neurohormonal and humoral (biochemical), as well as the known biophysical factors (change in various potentials, gradients, etc.). It is imperative to search for other, more efficient communication channels. At the

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same time, questions were validly raised already in the early works of Soviet scientists (A. G. Gurvich, E. S. Bauer, V. I. Vernadskiy, A. L. Chizhevskiy and others) concerning the thermodynamic characteristics of life processes, and efforts were made to investigate the informational mechanisms that are specifically inherent to biological phenomena. The existence of ultraweak electromagnetic radiation is now recognized universally, and it has been experimentally demonstrated in all tested plant and animal cells. It was found that so-called spontaneous fluorescence of biological systems is a universal property of living cells (Tarusov, 1965; Zhuravlev et al., 1961, 1975; Mamedov, 1976; Barenboym, 1966; Vladimirov, 1966; Marchenko, 1973; Konev, 1965; Rorr, 1979). The signaling function of this radiation is still debatable.

In this book there is discussion of the literature and results of the authors' experimental studies of the possibility of transmission of biological information by means of ultraweak electromagnetic radiation. For a long time, the authors and their colleagues have been working on the problem of "Ultraweak radiations in intercellular interactions." Much experimental material has been accumulated, which makes it possible to derive some conclusions as to the presence of remote intercellular electromagnetic interactions (electromagnetic bioinformation). Having studied for many years the ultraweak radiations in animal and human cells and tissues, we concluded that this phenomenon requires in-depth investigation, not only in the biophysical, but cybernetic aspects. With reference to ultraweak radiation of living cells from the cybernetic (informational) point of view, it can be assumed that control of biological processes is one of the main functions of electromagnetic radiation emitted by living systems. Radiation is recorded by physical methods, i.e., it can be identified as electromagnetic (of a specific frequency, very low intensity). These and other terms related to radiation were taken from physics, and they retain their physical meaning. However, the term, "biofield," taken from physics by A. G. Gurvich, cannot yet be identified as any specific physical field (electromagnetic, acoustic or other). The facts we have described are not ordinary, and they cannot be interpreted from the "recognized" vantage points of modern science. We cannot discuss with sufficient competence the obtained phenomenon of remote intercellular interactions in terms of an optical communication channel in the cybernetic or physicochemical aspect. At the same time, we must use terms taken from these sciences, and in some cases we describe their content intuitively. The possible mistake [incorrectness], from the point of view of specialists, is attributable to the fact that, being biologists, we preferred to retain only the biological level in evaluating the phenomenon described.

The purpose of this book was to call attention to a very important problem, that of transmission of electromagnetic biological information. In our opinion, solution thereof will make it possible to outline new approaches to such biological problems as development, growth, aging mechanisms and onset of malignant neoplasms. The search for possible routes of solving such important problems leads to efforts at generalizing and summing up the results of many years of investigations, which is what we tried to do in this book.

The authors express their sincere appreciation to the following: S. B. Stefanov, who offered considerable help in morphometric processing of our experimental data; B. M. Vladimirskiy; the staff of the Crimean Observatory and Biophysics Laboratory of the Institute of Clinical and Experimental Medicine, Siberian Branch of the USSR Academy of Medical Sciences, Prof N. N. Vorob'yeva and Prof A. N. Mosolov, who offered a number of valuable comments about this book.

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ADAPTATION, STRESS AND PREVENTION

Moscow ADAPTATSIYA, STRESS I PROFILAKTIKA in Russian 1981 (signed to press 12 Dec 80) pp 2-4, 275-276

[Annotation, foreword by O. G. Gazenko and table of contents from book "Adaptation, Stress and Prophylaxis", by Feliks Zalmanovich Meyerson, editor in chief--Academician O. G. Gazenko, Department of Physiology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 9200 copies, 278 pages]

[Text] This monograph deals with the problem of adaptation to physical loads, altitude hypoxia, difficult environmental situations and diseases. It is shown that adaptation to all these factors is based on activation of nucleic acid and protein synthesis, as well as formation of a structural trace in systems responsible for adaptation. A significant part of the book is concerned with discussion of possibility of using adaptation for the prevention of diseases of circulatory organs and the brain, as well as chemical prevention of stress-induced lesions. This book is intended for biologists and medical specialists concerned with problems of adaptation, training and stress, as well as cardiologists, pharmacologists and physiologists. Figures 50, tables 42, references 618.

Foreword

Adaptation of man and animals to the environment is one of the main problems of biology. This area of research was and is still the source of vivid examples of amazing perfection of living systems, as well as the arena for interesting scientific debates.

The last decade has imparted a distinctly pragmatic flavor to the adaptation problem. The demands made of man by the intensive development of civilization, exploration of air space, outer space, polar regions and world oceans have led to clear realization of the fact that use of the natural route of adaptation of an organism to environmental factors makes achievements possible that were impossible yesterday and permits preserving health under conditions that, it would seem, must inevitably cause illness and even death. It has become apparent that long-term, gradually developing and rather reliable adaptation is a mandatory prerequisite for expanding man's endeavors under unusual environmental conditions, as well as an important factor in enhancing resistance of a healthy organism in general and prevention of various diseases in particular. Purposeful use of long-term adaptation for these purposes requires not only general understanding of adaptation, not only a description of its diverse variants, but first of all disclosure of the

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endogenous mechanisms of adaptation. For the last 20 years, the research of F. Z. Meyerson, which is summarized in this book, has dealt expressly with this main problem of adaptation.

The book is based on the author's original conception of the mechanism of individual--phenotypic--adaptation of an organism to the environment. The main thesis of this conception is that environmental factors or new situations lead relatively rapidly to formation of functional systems that provide for only the initial adaptive reaction of the organism, which is largely imperfect. Appearance of a functional system per se is not sufficient for fuller and better adaptation; there must also be structural changes that fix the system and increase its "physiological power" in cells and organs that form such a system.

The correlation between function and genetic system of the cell, which exists in cells, is the key element of the mechanism that implements this process and, consequently, the key element of all forms of phenotypic adaptation. As shown by F. Z. Meyerson, a functional load elicited by environmental factors leads to increased synthesis of nucleic acids and protein and, as a result, to formation of a so-called structural trace in the systems that are specifically responsible for the body's adaptation to a specific environmental factor. Cytological, biochemical and physiological studies conducted by the author revealed that this is associated mostly with increase in mass of membrane structures responsible for the cell's reception of controlling signals, ion transport, energy supply, etc. The forming "systemic structural trace" constitutes the foundation for reliable, long-term phenotypic adaptation.

In developing this conception, F. Z. Meyerson found out that the role of the non-specific stress syndrome in onset of adaptation consists of "erasing" old structural traces and, so to speak, transferring the released resources of the organism to the systems where a new structural trace is formed that is consistent with the existing situation. The author formulates and validates theses concerning immediate and long-term adaptation, differences in architecture of systemic structural traces in adaptation to different factors within the framework of the conception advanced in this book. The author's ideas that the trace itself is, in essence, the structural equivalent of the dominant, that the system responsible for adaptation functions conservatively [economically] and, finally, the idea that anti-stressor systems exist which enable the organism to adapt even to difficult stress situations that would appear hopeless at first glance, are interesting and important. These new concepts are validated in the book by the results of comprehensive experimental research done in the author's laboratory, many of which have gained broad recognition both in our country and abroad.

I believe that the conceptions of F. Z. Meyerson concerning the substance of phenotypic adaptation and his experimental data pertaining to the successful use of adaptation to influence animal behavior and resistance to deleterious factors, as well as to prevent acute cardiac insufficiency, ischemic necrosis of the myocardium and hereditary hypertension, the pathogenesis of which is very similar to human essential hypertension, merit the reader's special attention. "Imitating the organism," the author used metabolites of natural antistressor systems and their synthetic analogues for effective chemical prevention of stress-related lesions to the viscera. Probably, these results will find application in the future to enhance resistance of healthy people, to prevent noninfectious diseases that constitute one of the main problems of modern medicine.

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This book addresses itself to a wide range of biologists and medical men, since all representatives of biology and medicine essentially encounter in the course of their work, somehow or other, the problem of adaptation of the sick or the healthy.

I believe that this new and interesting work on the problem of adaptation will be of keen interest to specialists in many branches of biology and medicine, and that it will serve as an additional impetus for research on this important problem.

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ANIMAL ADAPTATION TO WINTER CONDITIONS

Moscow ADAPTATSIYA ZHIVOTNYKH K ZIMNIM USLOVIYAM in Russian 1980 (signed to press 20 Nov 80) pp 2-4, 160

[Annotation, foreword by D. A. Kriivolutskiy and table of contents from book "Animal Adaptation to Winter Conditions", edited by Academician V. Ye. Sokolov, Institute of Evolutionary Animal Morphology and Ecology imeni A. N. Severtsov, USSR Academy of Sciences, Izdatel'stvo "Nauka", 2150 copies, 166 pages]

[Text] This collection is comprised of articles dealing with questions of adaptation of animals of different systematic groups (insects, soil invertebrates, amphibians, birds, mammals) to winter living conditions. The collection was based on papers delivered at the Soviet-Finnish symposium, which convened in April 1978. This book is intended for a wide circle of morphologists, ecologists and physiologists.

Foreword

The collection offered to the readers consists of the papers delivered at the Soviet-Finnish symposium on the topic of "Animal Adaptation to Winter Conditions," which convened in Moscow on 18-21 April 1978, in accordance with the plans for scientific and technological collaboration between the USSR and Finland. The symposium was organized and conducted by the organizing committee, which was formed by decision of the Department of General Biology, USSR Academy of Sciences; this committee was headed by Academician V. Ye. Sokolov, while all the technical work was done by the staff of the Institute of Evolutionary Animal Morphology and Ecology imeni A. N. Severtsov, USSR Academy of Sciences. About 30 Soviet zoologists, as well as 6 zoologists from Finland, participated in the symposium.

The meetings of the symposium began on 18 April 1978 with opening remarks delivered by Academician M. S. Gilyarov and greetings offered by I. B. Zbarskiy, corresponding member of the USSR Academy of Medical Sciences, chairman of the Soviet part of the Soviet-Finnish work group for collaboration in the field of zoology and experimental biology.

The topic of the symposium can be viewed as the traditional direction of work of zoologists and ecologists of the USSR and Finland over a period of many decades. In the boreal zone of the Palearctic region, where Finland and a significant part of the USSR are situated, the low winter temperatures and seasonal freezing of the ground or presence of permafrost place the strongest imprint on ecology of different animal species, their location over this territory, formation of fauna and structure of the animal population.

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The participants at the symposium demonstrated in their papers that low winter temperatures, particularly in very cold years, could cause a catastrophic decline in number of not only warm-blood animals or poikilothermic vertebrates, which was generally known before, but of many invertebrates.

The considerable experience in working on animal ecology at low temperatures, which was accumulated in the USSR and Finland, could not, of course, be used in its entirety and reflected in the proceedings of this recent symposium, nor did the organizers have this goal in mind. But the animated and productive exchange of opinions showed that ecologists of our country and Finland understand each other well, since they are working on similar problems and using the same investigative methods.

The symposium ended on 21 April, and one of the oldest Soviet ecologists, N. I. Kalabukhov, delivered the closing remarks. After the working program, there was unanimous approval of a resolution, in which the symposium participants noted the timeliness and benefit of convoking the conference, since the topic of the symposium reflects one of the main directions of work of zoologists of the two countries. It is unquestionable that continued research in this direction is very important to the study of the process of adaptive evolution, development of methods of controlling animals that are harmful to man in a cold climate, and animal acclimatization. The participants of the symposium noted the desirability of continued collaboration of Soviet and Finnish ecologists in the area of studying animal adaptation to low temperatures, cold winters, frozen ground, snow, etc., as well as in the efficient organization of this symposium.

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RIVER FLEET DIVERS

Moscow VODOLAZ RECHNOGO FLOTA in Russian 1978 (signed to press 16 Oct 78) pp 2-3, 103

[Annotation, introduction and table of contents from book "River Fleet Divers", by Anton Antonovich Stolbov, Vladimir Georgiyevich Larionov, Leonid Aleksandrovich Korchinskiy and Abram Borisovich Geyro, Izdatel'stvo "Transport", 6000 copies, 104 pages, illustrated, tables and 18 bibliographic references]

[Text] This book offers information about the lay-out of river vessels, construction and use of diving gear and equipment, organization and performance of underwater work from river transport, providing for safety of divers in such work. It also discusses some problems of river hydrology and diver medicine. The book is intended for divers, supervisors of diving work, foremen of river work, and it can also be used as a textbook for instructing third and second class divers of groups I-II specialization.

The introduction, chapters 1 and 4 were written by V. G. Larionov, chapters 2 and 3 by V. G. Larionov, A. A. Stolbov and A. B. Geyro, Chapter 5 by V. G. Larionov and A. B. Geyro, and chapter 6 by L. A. Korchinskiy.

Introduction

Development of the national economy of our country under the 10th Five-Year Plan is inseparably linked with increased transportation of cargo aboard water transport. For this purpose, new ports and mechanized docks will be constructed, the White Sea-Baltic Canal and several ports in Siberia and the Far East will be remodeled. There will be approximately a 22% increase in cargo handled by river transport under the Five-Year Plan. The increase in cargo turnover would be impossible without further improvement of navigation conditions on the waterways, without rock-removing and contraction [river engineering] work.

Divers are used in the construction and remodeling of ports, docks, piers, hydraulic installations and for improvement of navigation conditions on rivers and lakes.

The volume of diving work on waterways will increase by many times to implement the future plans for development of river transport, which call for establishment of a unified deep-water transport system in European USSR and radical improvement of navigation conditions on Siberian rivers.

The party and government are displaying their concern about the work, life and recreation of divers. Diving techniques and equipment are being improved, and

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heavy labor is being mechanized. New prototypes are being created of diving gear and equipment, rescue vessels and technical floating devices.

The work of a diver is specific, and it is virtually impossible to separate the labor or to specialize divers when performing diving work. In addition to knowledge about specialized equipment, the diver must be proficient in rigging, fitting and carpentry work, as well as underwater electric and gas welding, underwater cutting, rules for working with explosives and fundamentals of diver medicine. For this reason, the diving profession requires special training and constant upgrading of theoretical knowledge and practical skills.

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ANTHROPOLOGICAL DEVELOPMENT OF MAN IN PAST, PRESENT, FUTURE

Moscow CHELOVEK V PROSHLOM, NASTOYASHCHEM I BUDUSHCHEM (NOVOYE V ZHIZNI, NAUKE, TEKHNIKE. SERIA "BIOLOGIYA") in Russian No 5, 1981 (signed to press 22 Apr 81) pp 2-6, 64

[Annotation, foreword by Prof Ya. Ya. Roginskiy, doctor of biological sciences, and table of contents from book "Man in the Past, Present and Future. News in Life, Science and Technology, 'Biology' Series", by Mikhail Isaakovich Uryson, Tat'yana Ivanovna Alekseyeva and Nina Sergeyevna Smirnova, Izdatel'stvo "Znaniye", 44,390 copies, 64 pages]

[Text] The authors of this collection, who are on the staff of the Institute of Anthropology, Moscow State University, acquaint us with the current status of problems of paramount theoretical and practical importance, such as the antiquity of man, his ecology (correlations with the geographic environment, effect of climate, landform and other geographic factors on body schema, physiological and biochemical processes in the body, etc.), as well as man's evolution (prospects and tendencies).

Mikhail Isaakovich URYSON, candidate of biological sciences, senior scientist at the Scientific Research Institute of Anthropology, Moscow State University, has authored more than 70 scientific works on theoretical problems of anthropogenesis and evolutionary history of man.

Tat'yana Ivanovna ALEKSEYEVA, doctor of historical sciences, senior scientist at the Scientific Research Institute of Anthropology, Moscow State University, heads work dealing with the study of geographic variability of morphophysiological traits as related to the problem of man's adaptation to extreme living conditions. She has authored more than 100 scientific works in the field of race studies and physiological anthropology, including 5 monographs, 2 of which in collaboration with other authors. Tat'yana Ivanovna has been a member of the World Association of Human Biologists for many years, and she has participated many times in international congresses.

Nina Sergeyevna SMIRNOVA, candidate of biological sciences, junior scientist at the Scientific Research Institute of Anthropology, Moscow State University, has written more than 30 works on human morphology; she is a constant participant at international congresses of anthropological sciences, where papers were delivered on the ethnoterritorial specifics of man's morphological distinctions.

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Foreword

This pamphlet was written by major specialists, whose research is widely known in anthropology. The profound substantiation of the material they selected and its interpretation are unquestionable. The three articles are connected as the links of a time chain. Of course, the authors had to dwell only on the most important problems related to evolution of the human race in such a small popular publication. The choice of material is entirely consistent with the most current and pressing issues.

The principal content of the first article is referable to paleontology of higher primates of South and East Africa, covering all of the main finds of australopithecines and related forms, including transitory ones to the genus Homo. M. I. Uryson demonstrates convincingly the importance of these finds in confirmation of Darwin's theory of relationship of man to African anthropoid monkeys, about Africa as the ancient native land of the oldest hominids. Finds of the tools of the Olduvai culture in very ancient layers, the absolute age of which exceeds 2 million years, confirms the theory of the role of labor in the process of appearance of man. The author validly observes that the hominid family turned out to be much more ancient than was previously believed, but that the order of appearance of "human" traits predicted by C. Darwin and F. Engels was confirmed: first bipedalism and then, much later, increase in size of the brain and its differentiation. M. I. Uryson ends his article with a brief description of the change in forms of extremely ancient and ancient people, reporting the necessary information about their morphology and archeology of the Paleolithic age, adhering to stage theory.

The second article was written by T. I. Alekseyeva, who has authored many studies involving expeditions to different parts of the USSR, including regions characterized by extreme climate. She gathered vast material on morphology and physiology of the indigenous inhabitants of the arctic region, continental and temperate zones by herself or colleagues under her supervision. Studies were made of types of constitution, body proportions of indigenous population, metabolic parameters, levels of cholesterol, gamma globulin fraction, blood pressure and mineral metabolism. Some interesting and important links were demonstrated between the geographic environment and distinctions of the organism of indigenous population.

T. I. Alekseyeva, making extensive use of data in the literature, offers a description of different regions in the sense of their effects on the organism--arctic, continental, temperate, tropical, desert. Information is given about the effect of soil composition on skeletal mineralization. The author arrives ultimately at some substantial theoretical generalizations. The concept of adaptive type should be considered one of the most important.

Adaptive type refers to the inherited set of properties of an organism, but it is not the same as racial classification. It emerged much later than the major human races; it is formed in the course of ontogenesis and, not infrequently, at a very young age. The author describes well the basic differences between man and animals in adaptation to the geographic environment. One of the possible directions of future studies of interaction between human groups and the environment is considered, by this author, to be research on the correlation between the normal biological reaction to the environment and economic [industrial?] and cultural type as the norm of the social reaction. There is no need to prove the great theoretical and practical importance of problems discussed in this article.

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In many respects, the problems raised by the author have not been solved, and they merit continued comprehensive investigation. Their complexity becomes obvious, if we bear in mind that the most diverse factors often were present in the course of the history of people. Thus, when a group arrived in a mountainous region it was exposed simultaneously to the effects of not only climate conditions (air temperature, rarefaction, etc.) but of isolation. Moreover, these factors yielded different results, depending on the duration of the stay at high altitude, altitude above sea level, influences of the environment from which the people migrated to the mountains. The intensity of selection was not necessarily the same, depending on these circumstances.

Further, at some stage of its history an ethnic group in the tundra or forest zone could have been formed with mixing of various racial elements then, later on, be subject to the influence of the opposite process, i.e., isolation. Probably, this complexity of effects is the reason why seemingly analogous studies led to dissimilar results for different authors. It should also be borne in mind that, along with the effect of climate and the environment in general, physical conditions of industrious endeavors (hunting for marine animals, agriculture using a hoe, fishing in an ice hole, etc.) could also be significant.

The third article begins with a convincing critique of the predictions of J. Holden and many other authors, who maintained that there would be profound anatomical changes in the human body in the distant future.

N. S. Smirnova validly observes the enormous flexibility of man, both as an individual and in a group, the tremendous abilities contained in man's biological structure. In this article, much attention is devoted to cultural and historical complexes, i.e., ethnos. The author refers to the works by ethnographers, who pointed to the significant stability of ethnic composition of many peoples. In this regard, it is logical to touch upon the correlation between ethnos and race. As we know, there is a basic difference between them. Ethnos is a historical concept and, what is related to ethnic consciousness is a psychological one. Race is a biological concept. It is not surprising that there may be different racial elements in an ethnos and, on the other hand, that different ethnoses may consist of the same or very similar races. However, it is also common knowledge that, in the course of ethnos history, the range of distribution of ethnoses and races sometimes coincided, although there is no internal, profound and inseparable link between ethnos and race.

With all the complexity of processes of formation of ethnoses, it is important to note that there is some general tendency toward enlargement thereof. The process of formation of tribes, alliances of tribes, peoples and nations proceeded from generic organization. Apparently, in general, the larger the association, the more complex was the racial composition at the early stages of this association. Hence, stability of an ethnos and its internal unity could not fail to be achieved by means of racial mixing within the ethnos. There are quite a few nations that are mixed in composition, which retain their integrity as an ethnos.

I believe that this collection will be useful to all those concerned with problems of modern anthropology.

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FUNDAMENTALS OF SPORTS METROLOGY

Moscow OSNOVY SPORTIVNOY METROLOGII in Russian 1979 (signed to press 3 Sep 79)
pp 2-4, 150-152

[Annotation, foreword and table of contents from book "Fundamentals of Sports Metrology" by Vladimir Mikhaylovich Zatsiorskiy, Izdatel'stvo "Fizkul'tura i sport", 30,000 copies, 152 pages, illustrated]

[Text] This book consists of two parts. The first offers, for the first time in Russian literature, a systematic description of the main problems of sports metrology, including test theory, evaluation theory, etc. The second part of the book is a translation of international standards for measuring man's physical state and is comprised of the following sections: 1. Personal data and sports history. 2. Medical examination. 3. Physiological measurements and indexes. 5. Body schema and composition. 5. Principal motor tests. This part of the book can be used as a manual in examining athletes and as a guide. The book is intended for all those concerned with measurements and monitoring in sports: trainers, physicians, scientists, highest rank athletes and students at institutes of physical culture.

Foreword

This book consists of two parts:

1. Fundamentals of sports metrology.
2. International standards for measurement of man's physical state.*

The first part can be viewed as the theoretical foundation, upon which are constructed the described standards.

"Fundamentals of Sports Metrology" was written for individuals reading about the subject for the first time. The book can be used as an educational textbook for courses of sports metrology and biometry, as well as self-education. It is assumed that the reader is informed within the framework of the curriculum of institutes of physical culture. In particular, knowledge of fundamentals of mathematical statistics is essential to comprehend the book. Incidentally, readers who do not remember these basics too well can use Appendix 1, where the main concepts of statistics used in the book are explained.

*Prof V. M. Zatsiorskiy and Prof G. S. Tumanyan provided the translation, scientific editing and comments.

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Readers who are well-acquainted with test theory and rating theory will find that a number of questions are dealt with differently in this book. From this point of view, the book will probably be also of interest to them.

In view of the fact that sports metrology is a young science and its terminology has not yet been completely established, a list of the main concepts and terms in sports metrology is offered as an appendix (Appendix 2). They have been discussed several times in public.

Standardness of measurement procedures is a mandatory prerequisite for comparing results. The international standards make it possible to compare the data of different researchers in different countries, and they make substantially easier the work of an individual (not only scientist, but physician, trainer, instructor) who makes the examination and can direct his efforts toward solving his main problems, trusting the standards with regard to techniques used for taking measurements. This is far from a complete list of the advantages of standardizing tests.

Development of such standards is not an easy task. For this reason, it was logical to make use of international knowhow. The proposed international standards are the result of 10 years of work done by a large team of scientists from different countries. This work was done within the framework of the Committee for Standardization of Tests, which was founded in 1964 at the Olympic Scientific Congress in Tokyo (for several years, Prof S. P. Letunov was a member of this committee representing the Soviet Union). To date, only part of the standards have been approved, and they are submitted to the reader of this book.

We encountered two difficulties in making the translation and editing:

1. Several of the measurement procedures recommended by this standard do not conform to the measurement practice that is popular in our country (this applies, in particular, to the anthropometry section). Such instances are indicated in footnotes.
2. There are a number of English terms that do not have precise equivalents in our terminological system. This applies, in particular, to such a basic term as "physical fitness," listed in the heading of the standards. It is not very definite, even in English (at any rate, it has been submitted to repeated criticism in the Anglosaxon literature). The difficulty increases when it is translated into Russian. The literal translation, "physical suitability," does not seem to be quite fortunate; it seems to be a neologism, and the meaning of the original term (physical fitness) is broader than the Russian word "suitability" ["prigodnost"]. Such terms as "physical conditioning," "physical development" are also inaccurate. This term has been translated as "physical state," although some shades of meaning are lost in this translation. Where expressly these nuances are the most important, we have used the terms "physical conditioning" or "physical fitness ["suitability"]" depending on the context.

Translation of the standards was made without deviating from the text, with the exception of some obvious mistakes and typographic errors, which were corrected and noted in footnotes. We omitted only a few of the ancillary tables (in particular, conversion of units from the British to the metric system) contained in the appendix to the standard.

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Learning about international standards will probably be of interest to all who have any contact at all with monitoring and evaluation of man's physical state: pedagogues, trainers, physicians, anthropologists, physiologists and scientists in other specialties.

The author wishes to thank all his comrades who participated in the discussions about terminology, staff members of the department of biomechanics of the State Central "Order of Lenin" Institute of Physical Culture--M. A. Godik, T. P. Lazarenko, V. L. Utkin, who reviewed the first part of the book, as well as N. I. Volkov (bioenergetics), V. P. Chtetsov, Ye. Z. Godina (anthropology) and S. K. Sarsaniya (cardiology) who offered some valuable comments about the second part.

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RADIATION BIOLOGY

UDC: 577.3

HYPOTHESIS OF ENDOGENOUS RADIORESISTANCE BACKGROUND

Moscow GIPOTEZA ENDOGENNOGO FONA RADIOREZISTENTNOSTI in Russian 1980 (signed to press 29 May 80) pp 2-6, 147, 176

[Annotation, foreword by Prof A. B. Rubin, introduction, chart No 3 and table of contents from book "Hypothesis of Endogenous Radioresistance Background" by Yelena Nikolayevna Goncharenko and Yuriy Borisovich Kudryashov, Izdatel'stvo Moskovskogo universiteta, 1150 copies, 176 pages, illustrated]

[Text] This monograph deals with conceptions of biophysical and biochemical mechanisms of the radioprotective effect. There is critical discussion of biochemical conceptions, according to which processes occur in the body under the influence of radioprotective agents, which change the biological system into a state of temporarily heightened resistance to radiation. The book submits data on the mechanisms of formation and protective action of endogenous, biologically active substances. The book is intended for a wide range of different specialists--biologists, physicists, chemists, physicians, graduate and senior year students at relevant VUZ's.

Foreword

This monograph deals with a pressing problem of radiobiology and biophysics--determination of the mechanisms of chemical protection of biological systems against the destructive effects of ionizing radiation. The authors of this monograph, who are outstanding specialists--radiobiologists and biophysicists--have been working for many years in the field of research on primary processes of radiation sickness and closely related mechanisms of the radioprotective effect. In this book, there is critical discussion of modern hypotheses concerning the mechanisms of action of preventive agents and validation of the hypothesis expounded by the authors of "endogenous radioresistance background," which combines well their conceptions of endogenous radiosensitizing agents and endogenous radioprotective agents with current conceptions of physicochemical and biochemical mechanisms of protection. The authors' own experimental studies deal with virtually all aspects of the chemical radioprotective effect.

Research on endogenous lipid radiosensitizing agents, products of lipid peroxidation, was first begun by Yu. B. Kudryashov over 20 years ago, in connection with theory of primary mechanisms of radiation sickness developed by B. N. Tarusov. Ye. N. Goncharenko started to study the role of biogenous monoamines in formation of radioresistance of biological objects over 10 years ago. In 1969, the authors

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advanced the idea of complex endogenous background of radioresistance, which is the relationship between levels of endogenous protective and sensitizing agents that determine the system's resistance to radiation.

That same year, the Laboratory of Radiation Biophysics was set up in the Department of Biophysics on the Biology Faculty of Moscow State University, and under the leadership of Yu. B. Kudryashov research began there on endogenous radioresistance factors, mechanisms of their production and influence on primary and subsequent processes of radiation damage to biological objects and systems.

The staff of this laboratory obtained extensive experimental material to validate the endogenous background hypothesis. This material is systematized in the monograph and compared to data in the current literature.

Introduction

The effect of chemical protection against the deleterious action of ionizing radiation was first demonstrated in aqueous solutions in studies of the indirect effects of radiation and role of free radicals and peroxides of the aqueous environment in primary radiation processes. This is how the conceptions of "protective agents" and "protection" against radiation appeared (Dale, 1940, 1942). In a study of the mechanisms of indirect effect of ionizing radiation on enzyme solutions, V. Dale demonstrated that thiourea, colloid sulfur and formate can attenuate radiolysis of enzymes. He assumed that the observed protective effect occurs as a result of competition for free radicals of water, which appear when it is submitted to radiolysis. Subsequently, R. Latarjet and E. Ephrati (1948) described the radioprotective effect of cysteine, glutathione, tryptophan and other substances in experiments with bacteriophage. The effect of chemical protection against radiation was discovered in animals only in 1949, when C. Patt et al. found that cysteine protected rats against radiation lesion, whereas A. Herve and Z. Bacq demonstrated the radioprotective effect of cyanide on mice. In 1950, G. Liperos and V. Mosher obtained data indicative of protection of mice against ionizing radiation with thiourea. In the early 1950's, the works of Z. Bacq et al. (1951, 1952) were published, which dealt with the strong radioprotective effect on animals of cysteamine, serotonin, histamine, tryptamine, norepinephrine and tyramine. All of the tested agents were effective only when given prior to irradiation; for this reason they were named radioprotectors, while protection against radiation was called radioprophylaxis. By 1965, about 3000 radioprotective agents referable to different classes of compounds had been studied; however, only two classes--amino thiols and indolyl alkylamines--elicited the strongest radioprophylactic effect.

Of course, every since radioprotectors were discovered, efforts were made to explain the mechanism of their radioprotective effect. Numerous conceptions of mechanisms of protection were consistently based on the idea of attenuation of primary processes of radiation lesion by the radioprotective agents, i.e., processes of radiolysis of molecules before pathological changes had time to develop in the organism. Identification of the mechanisms of the radioprophylactic effect made it possible to pursue a purposeful search for radioprotective agents; however, the profusion of hypotheses made it difficult to choose the only route of synthesis of new radioprotective compounds and was mostly indicative of the large number of methods of expression of chemical protection of biological systems.

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In subsequent years, much attention was devoted not only to the search for new radioprotective agents, but modification of drugs in order to enhance their radioprophylactic activity. Radiobiologists and chemists directed their efforts toward expansion of the therapeutic effect of agents, differentiation of side-effects from influences determining the radioprophylactic effect, search for the means of prolonging radioprotective action, study of the effects of protective agents as related to exposure to local and divided doses of radiation, attenuation of the toxic effects of radioprotectors, etc. There was intensification of work on the combined use of protective agents with different biological action. The authors of many works dealing with the search for and refinement of radioprophylactic agents were governed by the conceptions of an "ideal radioprotective agent" (Tomson, 1964; Suvorov, Shashkov, 1975; Il'in et al., 1975).

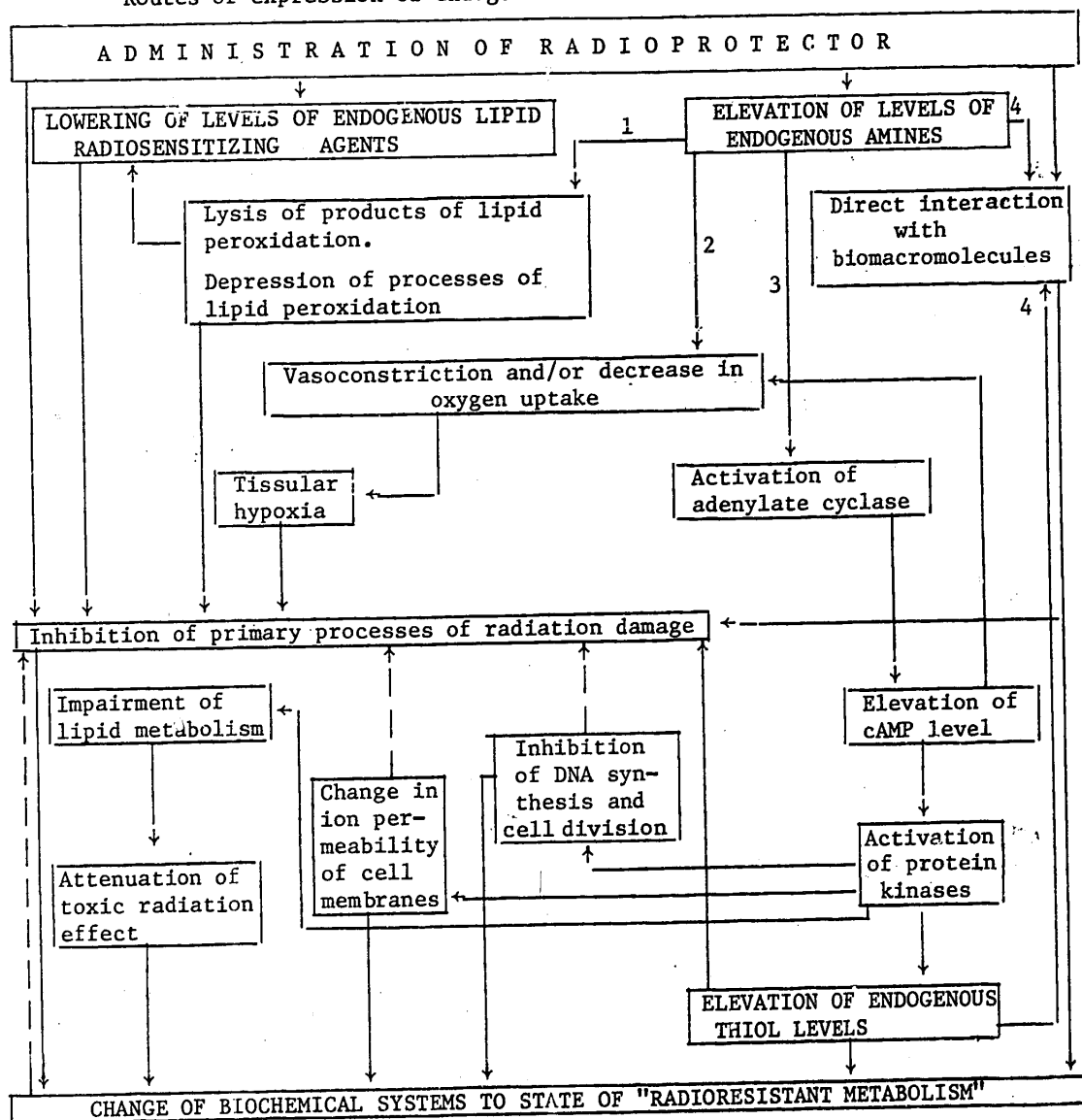
Current conceptions of processes of radiation damage served as the basis for various hypotheses of the abscopal mechanism of radioprophylactic effect. There are facts that indicate that the intracellular levels of administered radioprotective agents are not sufficient to protect systems against ionizing radiation; the amount of agent given is smaller than effective concentration thereof in irradiated solutions, while the capacity of a given protective agent to react with intracellular molecules or their radicals is hardly greater than that of endogenous substances. The very idea of chemical prophylaxis suggests that it is possible to prepare a biological system for exposure to radiation in advance. This makes it necessary to specify the processes that are causatively related to formation of radioresistance. The conceptions of an abscopal mechanism of radioprophylactic effect include hypotheses of "biochemical shock," "complex biochemical mechanism," "endogenous thiols" and "endogenous radioresistance background," which constitute attempts at determination and experimental validation of the significance of specific biochemical changes in the organism in the radioprotective effect. According to these hypotheses, a radioprotective agent is capable of inducing changes in a biological system by the time it is exposed to radiation that bring it to a state of heightened radioresistance.

There are many works dealing with the problem of radioprotection with chemical agents. Suffice it to mention only some of the monographs and surveys (Bacq, 1968; Grayevskiy, 1969; Grodzinskiy, Gudkov, 1973; Zharebchenko, 1971, 1978; Il'in et al., 1975; Mozzhukhin, Rachinskiy, 1964; Mosse, 1974; Rachinskiy, Slavachevskaya, 1965; Romantsev, 1963, 1968; Savich, 1978; Saksonov, Shashkov, Sergeyev, 1976, 1978; Sverdlov, 1968; Suvorov, Shashkov, 1975; Tomson, 1964; Khanson, Komar, 1978; Shal'nov, 1978; Eydus, 1972, 1977, 1978; Yarmonenko, 1969, 1977, 1978; Roumanou, Patome, 1978, and others), catalogues (Tiunov et al., 1961, 1964; Huber, Spode, 1961-1963, and others) and thereby eliminate the need for a comprehensive description of the entire problem of radioprotective effect. In this book, we shall limit ourselves to discussion of some of the most important conceptions, in our opinion, of mechanisms of preventive protection of biological objects and systems against the deleterious effects of ionizing radiation, and we shall acquaint the reader in more detail with the hypothesis of endogenous radioresistance background. In its general form, we expounded this hypothesis for the first time in 1969 (Kudryashov, Goncharenko). Since that time, a rather large amount of experimental material has accumulated and we felt that it was necessary to systematize and discuss it.

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Chart 3.

Routes of expression of endogenous radioresistance background



- Key:
- 1) effect on processes of lipid oxidation
 - 2) hypoxic effect
 - 3) effect on system of cellular regulation
 - 4) interaction with biomacromolecules

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HUMAN FACTORS

UDC: 621.:534

BIOMECHANICS OF MAN-MACHINE SYSTEMS

Moscow BIOMEKHANIKA SISTEM CHELOVEK-MASHINA in Russian 1981 (signed to press 5 Feb 81) pp 2-4, 121

[Annotation, foreword by K. V. Frolov, corresponding member of the USSR Academy of Sciences, and table of contents from book "Biomechanics of Man-Machine Systems", edited by K. V. Frolov, Izdatel'stvo "Nauka", 1750 copies, 121 pages]

[Text] This collection submits new results of theoretical and experimental research in the area of biomechanics of man-machine-environment systems. Theory of metric analysis of the dynamics of man-machine systems is developed; separation of neuronal systems is simulated; research on non-Euclidean biomechanics is described, as well as studies of resonance effects in biological systems; a survey is made of biomechanics of the visual analyzer; human equilibrium is explored; new models are proposed for predicting the physiological effect of vibration on man; theory of vibration protection of man is developed. This collection is intended for scientists and engineering-technical workers.

Foreword

As technology develops, man "communicates" more and more with machines, and this leads to formulation of new problems in the area of engineering, mechanics, biology, theory of oscillations, information theory and others. The advances in these fields are combined to solve a pressing problem of our times: refinement of existing machines and development of principles for construction of machines of the future. This collection, which was prepared in the Department of Biomechanics of Man-Machine Systems, Institute of Machine Science imeni Academician A. A. Blagonravov, reflects this tendency distinctly.

The book contains both new results of theoretical and experimental research, and new formulations of problems in biomechanics of man-machine-environment systems. Theory of metric analysis of the dynamics of man-machine systems is developed, which is necessary for optimum use of modern technology and automation of experiments: mathematical modeling of neuronal net function; research on non-Euclidean biomechanics with indication of the place of conformal geometric conceptions in describing living systems; frequency and oscillatory resonance effects are studied in biological systems and use thereof for transmission of information is indicated; there is a survey on biomechanics of man's visual analyzer; equilibrium of man's erect position is studied; new models are offered for forecasting the physiological effect on man of vibration; principles of construction and calculation of optimum systems of protection against vibration which contain pneumatic connections are discussed. These problems do not reflect the entire broad spectrum of problems

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of biomechanics of man-machine systems, but they do show some of the main directions of development of this modern science.

This collection is a continuation and enlargement of the published series of scientific works entitled "Fluctuations and Stability of Machines" (Moscow, Nauka, 1968), "Nonlinear Oscillations and Transient Processes in Machines" (Moscow, Nauka, 1972), "Vibration-Proof Insulation of Machines and Protection of Man Against Vibration" (Moscow, Nauka, 1973), "Protection of Man Against Vibration and Problems of Modeling" (Moscow, Nauka, 1973), proceedings of All-Union symposiums on the effects of vibration on man and problems of protection against vibration (Moscow, Nauka, 1972, 1974, 1977), as well as the proceedings of the international symposium on "Man and Vibration" (Italy, 1979), which was initiated and organized by the scientific staff of the Department of Biomechanics of Man-Machine Systems, Institute of Machine Science imeni Academician A. A. Blagonravov.

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PROBLEM OF INFORMATION PROCESSING IN MAN-MACHINE SYSTEMS

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 1, Jan-Feb 80 (manuscript received 1 Jun 78) pp 62-66

[Article by G. V. Vorob'yev and A. G. Yakovitskiy, Moscow]

[Text] Introduction. The problem of selecting the optimum structure of the man-machine system arises when processing preliminary information. The purpose of this article is to develop a method for calculating one of the units of a standard preliminary information processing scheme on reliability.

The processing scheme has the form of a directional series-connected operational circuit for information processing and monitoring in which fulfillment of the next operation begins after completion of the previous operation.

In the general case this scheme may consist of the following units: a storage device, sorting unit, coding unit, perforator, checking unit, computer calculating unit and final checking unit (figure). The work of the coding unit, as shown by operating experience, is the most stressful.

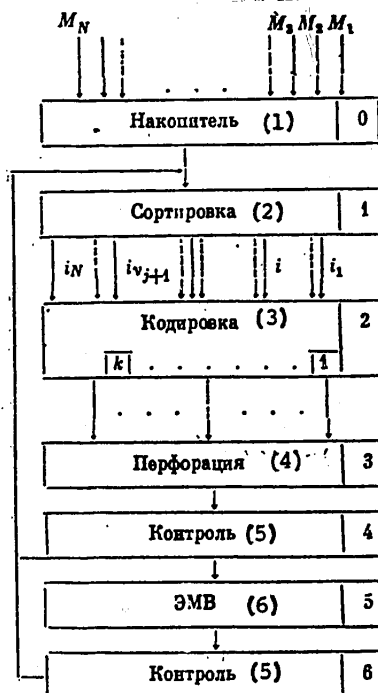
The problem of determining the minimum number of encoders with restriction on the probability of processing during a fixed time of information incoming during a certain moment is solved in this article.

1. Postulation of the problem. Let N Poisson requirement flows with intensities $\lambda_1, \lambda_2, \dots, \lambda_N$ enter the information processing system. The processing system (figure) consists of seven units in which the information comprising the requirement is processed.

The storage device gathers the requirements during time T and then transmits them to the first unit for processing. The first unit processes the requirements of any flow during random time η with distribution function $\theta(t)$ and then transmits it to the second unit.

The second unit, the encoding unit, consists of several encoders. Moreover, all the requirements of the i -th flow (we shall subsequently call them i -requirements) should be serviced by a single encoder and each encoder can process the requirements of any flows. If an encoder services several flows, then the order of servicing can be any order but if i -requirements begin to be serviced, then one can convert

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Key:

- | | |
|-------------------|----------------|
| 1. Storage device | 4. Perforation |
| 2. Sorting | 5. Checking |
| 3. Coding | 6. Computer |

to requirements of another flow only if all the requirements of the i -th flow are serviced. The time to process a requirement by the encoder is a random value ξ_i with distribution function $G_i(t)$. After completion of servicing the requirement by the second unit, it is serviced sequentially by the third, fourth, fifth and sixth units according to the figure.

Let us denote the distribution function of the time required to process the requirements in these units by $A_i(t)$ ($i = 1, 2, 3, 4$).

Return of the requirements to the first unit from the fourth and sixth units is possible, from which they begin to be serviced again. Besides the information coming from the flows indicated above, the system processes requirements of higher priority which come into the first unit within fixed moments of time within interval $(nT, (n+1)T)$. The time required to process this information is determined in each unit.

The encoders process this information jointly.

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The following postulation of the problem is of interest for the system described above.

Determine the minimum number of encoders in the second unit at which the following condition is fulfilled for any value of J :

$$P\{\tau_j(T) + S_j^* > t\} \leq P_{\text{зад}} \quad (1.1)$$

where τ_j is the total time to process all the requirements belonging to flows serviced by the j -th encoder and coming in during time T , S_j^* is the time during which the system processes information of higher priority assigned to the j -th encoder and t is the time during which all information must be processed. In practical situations frequently $t = T$.

2. Solution. Since the group of requirements is transmitted from the zero subsystem to the first system within equal time intervals T , then the number of requirements in the group coming to the first unit will be a random value distributed by Poisson law with parameters λT , where $\lambda = \sum \lambda_i$. However, two additional requirement flows (one from the fourth and the other from the sixth units) come in to subsystem 1. Let us assume that the probabilities of an arbitrary requirement returning from the fourth and sixth units are equal to P_1 and P_2 , respectively. The probability of an arbitrary requirement returning to the first unit will then be equal to $P_1 + P_2 - P_1P_2$. It is obvious that the number of requirements returned to each unit will have Poisson distribution with parameter $\lambda(P_1 + P_2 - P_1P_2)T$. The requirements returned to the first unit will again create a group of requirements returned a second time. The number of these requirements, similar to the previous one, will again have Poisson distribution with parameter $\lambda(P_1 + P_2 - P_1P_2)^2T$ and so on. Thus, the number of requirements passing through the first and second units of the system will be distributed by Poisson law with parameter

$$\lambda T = \lambda T \sum_{i=0}^{\infty} (P_1 + P_2 - P_1P_2)^i = \lambda T [1 - (P_1 + P_2 - P_1P_2)]^{-1}. \quad (2.1)$$

Distribution of the number of i -requirements is found in similar fashion.

One must know the types of flows which come into the second unit to calculate the number of encoders in it. The input flows of the second unit will be output flows for the first unit. Let us find the distribution function $R_v(t)$ of the length of interval ζ_v between two v -declarations leaving the first unit.

It is obvious that

$$R_v(t) = \sum_{n=1}^{\infty} P\{\eta_{i_1} + \dots + \eta_{i_n} < t | i_1 \neq v, \dots, i_{n-1} \neq v, i_n = v\} P\{i_1 \neq v, \dots, i_{n-1} \neq v, i_n = v\},$$

where η_{ij} is the time required to service an arbitrary requirement by the first unit and ij is the number of the flow to which the j -th requirement to be processed belongs.

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Since the probability, that the next requirement to be processed by the first unit will be a v -requirement, is equal to λ_v/λ , then

$$R_v(t) = \sum_{n=1}^{\infty} (1 - \lambda_v/\lambda)^{n-1} (\lambda_v/\lambda) \theta^{*n}(t).$$

Hence, we find that

$$M(\xi_v) = \int_0^{\infty} t dR_v(t) = M(\eta) (\lambda/\lambda_v).$$

If there exist at least K flows such that

$$M(\xi_v) < M(\xi_j) \quad (j \geq K), \quad (2.2)$$

then we can distribute the flows by encoders such that a queue will always be in front of each encoder. It is obvious that to do this, the j -th encoder should begin processing with the v_j -requirements.

If one also assumes, besides condition (2.2), that condition (2.3) is fulfilled for any value of v ($1 \leq v \leq N$):

$$M(\xi_v) \gg A_i \quad (i=1, 2, 3, 4), \quad (2.3)$$

where A_i is the average time required to process the requirements, then the distribution function of the time the system is engaged will be determined mainly by the distribution function of the time the encoders are engaged.

Moreover, in this case we can replace our system by an equivalent system having no feedback but having input flows corrected in the manner indicated above. Since we shall subsequently consider an equivalent system, then let us denote the parameters of the input flows by λ_i ($i = 1, \dots, N$).

Let $U_i(t)$ be the distribution function of the time required to service all i -requirements coming in during some moment of time nT . It is obvious that

$$U_i(t) = \sum_{n=0}^{\infty} \exp(-\lambda_i T) \frac{(\lambda_i T)^n}{n!} G^{*n}(t), \quad (2.4)$$

$$F_j(t) = P\{\tau_j(T) < t\} = U_{i_1} * \dots * U_{i_m}, \quad i_j \in \Lambda_j, \quad (2.5)$$

where Λ_j is the aggregate of the indices of the flows to be serviced by the j -th encoder.

However, calculation of $P\{\tau_j(T) > t\}$ -- the probability that the total time to process the requirements of the equivalent flow by the j -th encoder during time T

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exceeds the given time is difficult by formulas (2.4) and (2.5). At the same time the series (2.4) can be used to estimate probability (2.5). This estimate can be found by using the following theorem [1].

Theorem. If there exist positive constants h_i and u_j such that $M \exp(xS_i) \leq \exp(1/2 h_i x^2)$, for all values $x \in [0, u_j]$ and $i \in \Lambda_j$, then

$$\begin{aligned} P\{\tau_j(T) > t\} &\leq \exp(-t^2/2H_j), \text{ if } 0 \leq t \leq H_j u_j, \\ P\{\tau_j(T) > t\} &\leq \exp(-tu_j/2), \text{ if } t > H_j u_j, \\ H_j &= \sum_{i \in \Lambda_j} h_i. \end{aligned} \quad (2.6)$$

Thus, to estimate probability (2.5), one must find h_i for all values $i \in \Lambda_j$ and u_j which would yield the best approximations.

Let $g_i(x) = M \exp(x\xi_i)$, then

$$M \exp(xS_i) = \exp[\lambda_i T(g_i(x) - 1)]. \quad (2.7)$$

Hence

$$h_i \geq 2\lambda_i T(g_i(x) - 1)/x^2. \quad (2.8)$$

Difficulties in using estimates (2.6) arise in some cases, related to the fact that the value of h_i does not exist that satisfies inequality (2.8) at any values of u_j . Sometimes one can still estimate $P\{\tau_j(T) > t\}$, having oriented oneself to random values S_i .

However, far from all constants h_i always exist even for centered values of S_i . If the time of accumulation is high compared to the average time between the arrival of the requirements, then making use of the apparatus of renewal theory [2], one can find the asymptotic formula for calculating the probability under consideration.

It is obvious that probability $P\{\tau_j(t) > t\}$ does not depend on the order of servicing the requirements and consequently when deriving the estimate for this probability one can consider a single requirement flow with intensity $\rho_j = \sum_{i \in \Lambda_j} \lambda_i$. In this case the distribution function of the time required to service a single requirement from this flow $\xi^{(j)}$ will be equal to

$$V_j(t) = \frac{1}{\rho_j} \sum_{i \in \Lambda_j} \lambda_i G_i(t).$$

One can then determine $\tau_j(T)$ as a process of accumulation in the following manner [2]:

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$$\tau_j(T) = \begin{cases} \sum_{i=1}^{N_T} \xi_i^{(j)} & (N_T=1, 2, \dots), \\ 0 & (N_T=0), \end{cases}$$

where N_T is the number of declarations coming into the storage device during time T .

If the mean values and standard deviation of $\xi^{(j)}$ can be denoted by μ_j and d_j , then

$$M(\tau_j(T) | N_T=r) = r\mu_j, \quad D(\tau_j(T) | N_T=r) = rd_j. \quad (2.9)$$

With a sufficiently large fixed value of r , the value of $\tau_j(T)$ is approximately normal to the mean value and standard deviation (2.9). Consequently its distribution function of the moments is equal to

$$\exp(-r\mu_j P + 1/2 r d_j P^2). \quad (2.10)$$

The unconditional distribution function of the moments is equal to the mean value of expression (2.10) with respect to the distribution of random value N_T , which is itself approximately normal to the mean value of $T\rho_j$ and to the same standard deviation at a large value of T . Thus, the mean value with respect to the asymptotic distribution is equal to

$$\exp\{(-\mu_j P + 1/2 d_j P^2) T\rho_j + 1/2 (-\mu_j P + 1/2 d_j P^2)^2 T\rho_j\}.$$

If this expression is transformed to the distribution function of the normalized value

$$[\tau_j(T) - \mu_j \rho_j T] / [(T\rho_j + \mu_j^2 d_j \rho_j^2 T)^{1/2}],$$

then at $T \rightarrow \infty$ we find $\exp(P^2/2) \{1 + o(1)\}$, i.e., the value of $\tau_j(T)$ is asymptotically normal to the mean value and standard deviation equal to, respectively,

$$\begin{aligned} M(\tau_j(T)) &= \mu_j \rho_j T, \\ D(\tau_j(T)) &= T(1/\rho_j + \mu_j^2 d_j \rho_j^2), \end{aligned} \quad (2.11)$$

hence, one can easily find the necessary estimate.

Using estimates (2.6) or normal distribution with parameters (2.11) and by distributing the flows such that the mean times of the encoders being engaged are identical if possible, one can construct the algorithm for solving the problem in the following manner.

1. Let us find K flows ($K = 1$ on the first step) in which the expression $[\lambda M(\eta)] / [\lambda M(\xi)]$ assumes a minimum value and let us assign it to each encoder for a single flow. (In this case we best ensure that condition (2.2) is fulfilled).

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2. That among the remaining flows is selected in which the maximum value of $M(S_i)$ is achieved.
3. The number of the encoder with minimum average time to service the requirements of all the flows assigned to it is selected.
4. The flow selected in paragraph 2 is assigned to the encoder selected in paragraph 3.
5. If all the flows are distributed, let us go on to paragraph 6, otherwise let us go to paragraph 2.
6. If at least one value of j ($j = 1, \dots, K$) $t - S_j^* - M\tau_j(T) \leq 0$, then let us add an additional encoder and go on to paragraph 1, otherwise let us go on to paragraph 7.
7. Let us check fulfillment of condition 1. If the condition is not fulfilled, then the number of encoders must be increased by one and we transfer to paragraph 1, otherwise the problem is solved.

When using formulas (2.6), the values of u_j that yield the most accurate estimate should be found. A unit that determines these values of u_j is provided in the program realizing this algorithm. The algorithm is realized on the BESM-6 computer. The program is written in FORTRAN language.

Example. Let the distribution $G_i(t)$ be normal distribution with parameters m_i and σ_i . In this case there are no constant values h_j for any interval $[0, u_j]$ since the right side of (2.8) approaches infinity at x , approaching zero. At the same time if one considers the centered value \bar{S}_i , then

$$\lim_{x \rightarrow 0} (2\lambda_i T (g_i(x) - 1)/x^2) = \lambda_i m_i^2 + 2\lambda_i \sigma_i^2$$

and consequently for any finite segment $[0, u_j]$, the right side of (2.8) is limited, i.e., there are constant values of h_j that satisfy (2.8). Since

$$P\{\tau_j(T) + S_j^* > t\} = P\{\bar{\tau}_j(T) > t - S_j^* - \mu(\tau_j(T))\},$$

then to find the estimates it is sufficient to substitute t for $t - S_j^* - \mu(\tau_j(T))$.

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UDC: [007:57+007"573.6+615.47](07)

BIOENGINEERING SYSTEMS: THEORY AND DESIGN. A TEXTBOOK

Leningrad BIOTEKHNIЧЕСКИЕ СИСТЕМЫ: ТЕОРИЯ И ПРОЕКТИРОВАНИЕ. УЧЕБНОЕ ПОСОБИЕ
in Russian 1981 (signed to press 15 Dec 80) pp 2-4

[Annotation and table of contents from book "Biotechnical Systems: Theory and Design. A Textbook" by V. M. Akhutin, A. P. Nemirko, N. N. Pershin, A. V. Pozharov, Ye. P. Popechitelev and S. V. Romanov, reviewed by N.A. Mikhaylov, deputy chief designer, Special Design Office for Biological and Medical Cybernetics at the Leningrad "Order of Lenin" Electric Engineering Institute imeni V. I. Ul'yanov (Lenin), and K. Yu. Agranovskiy, doctor of engineering sciences (Northwestern Polytechnical Institute, recommended by the Leningrad "Order of Lenin" Electric Engineering Institute imeni V. I. Ul'yanov (Lenin), Izdatel'stvo Leningrad University, 1734 copies, 220 pages, 42 figures, 5 tables, 120 references]

[Text] In spite of the promise held in development of bioengineering systems and possibility of wide use thereof in practice, there have not been special monographs and especially educational and methodological literature heretofore dealing with the description of theory of such systems and questions of practical use thereof in medicine, various types of engineering, as well as scientific research. This textbook, while it does not presume to cover the topic completely, discusses comprehensively theoretical questions of systems analysis as it applies to bioengineering systems, methods of modeling and synthesizing them, and classifying them. Bioengineering systems for different purposes--monitoring, therapy, clinical laboratory use--are discussed on a sophisticated scientific and methodological level. This textbook is intended primarily for senior year students specializing in medical instrument making, and it will also be very useful to a wide range of specialists involved in development and operation of such systems.

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SCIENTIFIC ORGANIZATION OF LABOR OF MARITIME FLEET PERSONNEL

Leningrad TRUDY TSNII MORSKOGO FLOTA, VYP 253: NAUCHNAYA ORGANIZATSIYA TRUDA
PLAVSOSTAVA MORSKOGO FLOTA in Russian 1980 (signed to press 9 Jun 80) pp 82-84

[Abstracts and table of contents from book "Works of Central 'Order of Red Banner of Labor' Scientific Research Institute of the Maritime Fleet, No. 253: Scientific Organization of Labor of Maritime Fleet Personnel", edited by Yu. I. Panin, Izdatel'stvo "Transport", 1405 copies, 84 pages]

UDC: 656.612:658.387

USE OF STOCHASTIC METHODS IN THE STUDY OF WORK PERFORMED BY CREW MEMBERS

[Abstract of article by R. V. Shchelgachev]

[Text] There is discussion of methods for studying work processes, which are used in different sectors of industry, and they are briefly evaluated. Standard observation charts are recommended, with which one can determine the nomenclature and duration of work operations for the period of watch duty, as well as in the course of performing work pertaining to technical maintenance of a vessel and its equipment. Tables 3.

UDC: /656.612:658.387/003.13

EVALUATION OF ECONOMIC EFFECTIVENESS OF STUDIES DEALING WITH IMPROVEMENT OF WORKING CONDITIONS ABOARD VESSELS

[Abstract of article by Ye. P. Zagorskaya]

[Text] The described method provides a scientific approach to evaluation of the economic effect of work pertaining to labor safety for ship crews. A method is described for determining the national economic and departmental effect. A set of formulas is given, as well as criteria for scoring the work of seamen. Figures 1, tables 5.

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UDC: 656.615.06

ORGANIZATION OF COMPLEX FLEET SERVICING DURING ANCHORAGE PERIODS

[Abstract of article by R. V. Shchelgachev and A. B. Vlasova]

[Text] Organization of complex servicing of vessels and their crews, as well as directions of future research, are discussed.

UDC: 656.612:658.387.015

EFFECT OF AUTOMATION OF VESSELS ON SEAMEN'S WORKING CONDITIONS

[Abstract of article by Ye. P. Zagorskaya and A. A. Tret'yukhin]

[Text] Analysis is made of the causes of traumatism among ship's crews when servicing ship equipment. Questions of lowering traumatism as a result of introducing automation on modern vessels of the maritime fleet are explored. Problems related to automation of ship power plants to the extent of assigning to the vessels automation emblems in symbols of the USSR Registry class A1 and A2. Tables 2.

UDC: 656.612:658.387.015

ORGANIZATION OF LABOR OF SHIP CREWS ABOARD AUTOMATED VESSELS

[Abstract of article by N. T. Yeliseyev]

[Text] Experience of operating vessels with the automation emblem in the class symbol of the USSR Registry is summed up. Tables 1.

UDC: 629.12.06:697.94

INERTIAL HEAT PROPERTIES OF ENCLOSURES AND EQUIPMENT OF AIR-CONDITIONED PREMISES

[Abstract of article by V. I. Lysev]

[Text] The transfer function is given for enclosures and equipment as related to change in air temperature in air-conditioned premises. References 3.

UDC: 656.612:658.32

METHODOLOGICAL BASES FOR CLASSIFYING VESSELS FOR PURPOSES OF WAGES AND SETTING UP PAY SCALES FOR SHIP CREWS

[Abstract of article by R. S. Rez and T. N. Lekintseva]

[Text] There is discussion of questions of categorizing maritime fleet vessels into groups according to wages of commanding officers and setting up pay scales. A basically new approach is offered to classification of vessels on the basis of a complex indicator, and the formula for calculation thereof is provided. A method is described for scoring the difficulty of labor as the basis for setting up salary scales. Figures 1, tables 3.

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UDC: 656.612:658.387.015

SCIENTIFIC ORGANIZATION OF LABOR REQUIREMENTS REFERABLE TO THE FORE BRIDGE OF A MARITIME VESSEL

[Abstract of article by V. F. Palastrov]

[Text] Requirements are listed for scientific organization of labor related to the fore bridge, with its equipment and installations. Figures 3, tables 2.

UDC: 656.612:658.3

PSYCHOSOCIAL ADJUSTMENT TO THE START OF A VOYAGE

[Abstract of article by V. N. Parokhin and R. S. Araslanova]

[Text] Analysis is made of some of the distinctions of psychosocial adjustment of sailors [or deck officers] to the first days of a voyage and its effect on sailing safety. Figures 2, tables 2; references 4.

UDC: 656.3

CLASSIFICATION OF CONDITIONS AND NATURE OF SEAMEN'S WORK ACCORDING TO DEGREE OF HARMFULNESS AND INTENSITY

[Abstract of article by L. M. Matsevich]

[Text] A system is offered for complex evaluation of working conditions of seamen according to degree of harmfulness and intensity [tension]. Tables 2, references 4.

UDC: 656.612:658.3

RESULTS OF TESTING SOME PSYCHOLOGICAL TRAITS OF SAILORS ON A RADAR TRAINER

[Abstract of article by V. N. Parokhin, R. S. Araslanova, A. Ye. Druzhinin and I. K. Shirokova]

[Text] Results are submitted that describe professional training achievement of sailors on radar trainers as a function of individual psychological traits. Figures 1, tables 2, references 3.

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DECISIONS: THEORY, INFORMATION AND MODELING

Moscow RESHENIYA: TEORIYA, INFORMATSIYA, MODELIROVANIYE in Russian 1981 (signed to press 2 Apr 81) pp 2-3, 328

[Annotation, excerpt from foreword and table of contents from book "Decisions: Theory, Information and Modeling", by Eduardas Yonovich Vilkas and Yefrem Zalmanovich Mayminas, Izdatel'stvo "Radio i svyaz", 10,000 copies, 328 pages, illustrated]

[Text] Fundamentals of general theory of decisions, analysis of their informational aspects and problems of modeling decision making problems are discussed. This book is intended for scientists and specialists dealing with decision theory, development and application of mathematical methods and models to the control of the economy, as well as development of automated control systems.

Foreword

As indicated by Jonathan Swift, in a conversation with Gulliver Aristotle observed that new systems in nature change with each generation, like fashions, and that even philosophers who try to prove them by the mathematical method do not succeed for long and go out of fashion at the time prescribed by fate. This warning hung over us, like the sword of Damocles, particularly since fashions change in our times much faster than in the times of Aristotle or Swift.

We are living in a rapidly changing world that is growing increasingly complex. Factors that must be taken into consideration in making every decision are becoming more and more numerous, diverse and interrelated. Its consequences are increasingly spread in time and space, and often unexpected. For this reason, intuition and individual experience missfire more and more often, and interest is growing in scientific investigation of the decision making process.

It is not surprising that this problem is drawing the attention of many specialists--philosophers and economists, mathematicians and psychologists, sociologists and engineers. The scope and diversity of scientific work on decision making have become quite impressive. In general, two categories of studies and two methods of analyzing the problem have become rather distinctly evident in the existing literature. One group consists of relatively abstract research, in which the entire process of making any decision, some stage or special instance thereof, is discussed from a selected vantage point. The other group consists of concrete studies dealing with certain types of decisions in the engineering, economic, military or other

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field. With rare exceptions, one can again distinguish two means of analysis and presentation of material in both groups: in the former case, the authors construct their presentation on formalized models, which are studied by also formal, mainly mathematical methods; in the latter case, they base themselves primarily

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AIRCRAFT, PILOTS AND FLIGHT SAFETY

Moscow SAMOLET, LETCHIK I BEZOPASNOST' POLETA in Russian 1979 (signed to press 15 Nov 79) pp 3-5, 220-224

[Annotation, foreword and table of contents from book "Aircraft, Pilots and Flight Safety", by Grigoriy Semenovitch Kalachev, Izdatel'stvo "Mashinostroyeniye", 6500 copies, 224 pages]

[Text] This book deals with the main qualities of an aircraft: stability, controllability and maneuverability. Analysis of these qualities is made on the basis of factual material and instrument records during tests and operation; practical recommendations are offered on aircraft piloting, methods of making test flights and choice of criteria of important design and aerodynamic parameters of an aircraft. This book is intended for design engineers, aerodynamic specialists, test pilots and other aviation specialists.

Foreword

High efficiency of aircraft operation and flight safety depend on both the qualities of the aircraft and of the pilot controlling the flight. The qualities of an aircraft are characterized by its stability, controllability and maneuverability, as well as reliability and dependability of construction of the aircraft and various equipment and units on it. Pilot qualities depend on his theoretical training, knowledge of the physical aspect of the aircraft and instructions on operating it, degree of flight training of the pilot if the aircraft encounters unusual circumstances, pilot comprehension of the patterns of aircraft traffic [or movement] in various situations with due consideration of its aerodynamic features, stability and controllability features of aircraft in general and the type flown by the pilot at that time in particular.

Stability, controllability, maneuverability and flight safety are the most important basic qualities of an aircraft, and they are closely interrelated. Problems of both theory and practice of providing good indicators of these aircraft qualities are among the rather complex ones. Investigation and comprehension of these problems are related to many various parameters, methods of calculating and testing parameters to rate an aircraft, and the constructive elements used. In view of the increased speed and altitude of flight, it has become necessary to take into consideration comprehensively the effect of compressibility of air on aerodynamics of the aircraft. The construction of aircraft has become appreciably more complicated; wide use is being made of various automatic devices aboard aircraft, and some new and substantial distinctions have appeared in their stability and controllability characteristics.

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Technically sophisticated design and operation of modern aircraft require that engineers, designers, operating engineers and pilots have a large volume of knowledge. The intensive development of aviation science and practice has been reflected in current textbooks and technical literature used in the training of engineering and flight personnel. However, this literature often contains much material and calculations referable to special questions of stability, controllability and maneuverability, but not enough data on the behavior and piloting of aircraft in typical flight situations related to the effect of compressibility of air and deformation of construction on aircraft aerodynamics.

This book discusses problems of the relationship between aircraft, pilot and flight safety. The aircraft is discussed on the basis of its stability, controllability and maneuverability; the pilot, on the basis of his requirements as to the qualitative and quantitative expression of these characteristics, as well as the characteristics of his piloting under special (irregular) flight conditions, including typical errors. Flight safety is defined, as we have already stated, by the combination of aircraft and pilot properties under different flying conditions.

To demonstrate aircraft and pilot properties, typical examples of flight accidents are used in this book, taken from the incidents that have occurred in the practice of flight tests and aircraft operation. The author was directly involved in the investigation of many of these occurrences. In submitting the results of the investigations, the author tried to offer the general conclusions and concrete recommendations to improve flight safety.

Of course, some of the theses and recommendations developed in this book reflect the author's personal opinion.

In view of the wide range of expected readers, the author tried to make his presentation understandable to all and, at the same time, rather strict. Chapter 1 deals with definition of the main concepts, mainly classical ones, and terms used in the book. Analysis is made of the correlation between stability, controllability, maneuverability and flight safety. Then, Chapter 1 also gives a brief history of development of theory and practice of providing for these aircraft qualities. In conclusion, there is brief description of the methods and parameters used to assess stability and controllability according to test results.

Chapters 2 and 3 discuss the effects of different important characteristics of stability and controllability on movement of the aircraft in air and control thereof by a pilot under various specific conditions. Most of the instances discussed in the book are related to unintentional departure of the aircraft beyond the range of restrictions stipulated in the instructions on operating and flying a given type of aircraft. Some of the special cases discussed are unique.

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PROBLEMS OF TIME ORGANIZATION OF LIVING SYSTEMS

Moscow PROBLEMY VREMENNOY ORGANIZATSII ZHIVYKH SISTEM in Russian 1979 (signed to press 31 May 79) pp 2-7, 143-147

[Annotation, introduction, abstracts and table of contents from book "Problems of Time Organization of Living Systems" edited by A. M. Genin, doctor of biological sciences, Izdatel'stvo "Nauka", 1450 copies, 147 pages]

[Text] This collection deals with problems of biorhythmology (chronobiology). It discusses questions of adaptogenesis in living systems in the aspect of their time organization and dynamics of their circadian rhythms. Data are submitted concerning development of mathematical analysis of human biological rhythms. Results are described of experiments characterizing the distinctions of biological rhythms when animals are exposed to changing illumination and hypokinesia. This collection is intended for specialists in the field of biorhythmology, physiologists, biologists, physicians and other specialists concerned with the problem of time organization of living systems.

Introduction

Throughout the history of natural science, researchers were constantly concerned with questions of time organization of living systems. As they peeled off the layers of earth's crust, like the pages of an enormous book, people became convinced of the variability of the plant and animal kingdom when they were faced, in the fossilized monuments of that kingdom, of generations of its precursors, many of which appeared to be the materialized creations of the exquisite imagination of unusual thinking beings. Half-erased records were preserved on the first pages of this book about the first representatives of terrestrial life, the primitiveness of which seemed to be an echo of a remote time that acquired in these records its own genuine, sensed reality. Who could deny having had the physical sensation of unrushed breathing of time in a museum of paleontology? Who is not captured and carried by its powerful flow, its mysterious and secret river, fixed in expressly this image in the monuments to the creativity of ancient peoples? The living bearer of the continuous course of time--man--is exceptionally sensitive to the objective truth of real movement, which became for him one of the recognized coordinates of the world around him, the coordinate of time.

Like paleontology, embryology revealed to man the facet of life that is organically interwoven with the phenomenon of time, imparting to it "tangible" reality. One refers to philogenesis and ontogenesis as they apply to the actual process of inception of life in the aspect of its history and the aspect of its individual

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development. And nothing emphasizes better than Haeckel's law the inseparable link between the process of development in these two aspects: ontogenesis repeats phylogenesis.

Thus, in the aspect of both general and individual history of an organism, natural scientists constantly encounter factors indicative of time organization of living systems, facts of their continual variability. However, the same natural scientists suddenly lost the "sense of time" as soon as they turned to analysis of the current state of such systems and, in spite of numerous facts, viewed life as some phenomenon like themselves that is independent of time. This thesis in natural science constituted a uniquely validated status in physiology and applied biology for several centuries, although there was sporadic publication of works, in which efforts were made to include the time phenomenon with biological parameters. These works include, first of all, the studies of fluctuating, periodic processes in the organism, particularly those with a period of 24 h. Apparently, such biological rhythms were first recorded in plants. According to the literature, the French astronomer, deMeran (1729),* was among the first (if not the first) to describe the circadian rhythms of movement of leaves under constant temperature and illumination conditions. Then the representatives of a number of natural sciences turned to the phenomenon of circadian rhythms. The data obtained from such studies were not questioned; however, they did not have an appreciable influence on the general situation in physiology and applied biology, where the traditions of "static" natural science continued to prevail. Expressly they--these traditions--were among the serious reasons why researchers disregarded the time aspect of organization of living systems. No doubt, purely methodological difficulties of studying various forms of life played an important role in this respect also, with reference to their constant variability, spontaneous, never ceasing movement, and movement in an ascending line rather than in a circle, movement that always carried something new to the organism.

There was a noticeable change in world outlook of natural scientists, primarily with respect to phenomena in organic life, in the first half of this century, which was related to the major achievements in many branches of science and, specifically, the direction that was named chronobiology abroad and biorhythmology in the USSR. The increased interest in chronobiology (biorhythmology) was related primarily to the rapid progress in means of transportation, particularly airborne. Jet aircraft can overcome enormous distances in a short time (usually measured in hours rather than days). The practice of such flights very soon revealed that rapid crossing of several time zones was associated in a number of people with diverse disturbances of well-being, work capacity, sleep, appetite and often morbid symptoms resembling prodromal states, i.e., the symptom complex that Selye called the stress syndrome or general adaptation syndrome. Practitioners very soon realized the significance**

*See Yu. Aschoff, "Exogenous and Endogenous Components of Circadian Rhythms," in "Biologicheskoye chasy" [Biological Clock], Moscow, Mir, 1964, pp 27-59.

**"Crews," observes Fabbro (G. D. Fabbro, "I Voli di 'Lungo Raggio' ed i ritmi circadiani," MINERVA MEDICA, Vol 61, No 74, 1970, pp 3922-3928), "are well aware of the difficulties that may be experienced with a change in time zones and they do all they can to overcome them." In this case, we are dealing with aircraft crews. Several special studies demonstrated that crews of transport aircraft tried to curb the morbid disorders occurring with a change to other time zones. In particular, older pilots tried to leave the airport of their final destination as quickly as possible in order to return as soon as possible to their customary place of residence.

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of such a stress syndrome, induced by a time "gradient." "Business people" also encounter the same difficulties and, if they do not take this syndrome into consideration, they could find themselves unable to use all their intellectual capacities. Consequently, all those who make long-distance flights crossing the meridians must rest properly before they start to work.

Disturbances analogous to those that develop after transmeridional flights are always observed when the usual schedule is changed, which occurs for example in the case of work in three shifts. According to foreign and Soviet researchers, working in the evening and night shifts is associated with some decline of labor productivity and increase in number of mistakes. G. Leman [1967],* a major specialist in the field of industrial physiology, believes that people who work at night, even for decades, for example nurses, retain the usual circadian rhythm of vital functions, with a minimum at 0300 hours; consequently, in spite of their apparent adjustment to night work, their life proceeds against [despite] the biological rhythm.

The situation of working against [or despite] the biological rhythm also applies to submarine crews who participate in distant voyages, participants of geological expeditions, arctic and antarctic missions, cosmonauts in orbital and interplanetary flight, as well as athletes who perform in foreign countries.

The stress syndrome, which occurs in all such situations, is related to changes in customary sleep-wakefulness rhythm, which are followed by changes in phase of all rhythms of the body that have a period of about 24 h. The mismatch of 24-h (or close to 24 h--circadian, which equal about 24 h) rhythms has been named desynchronosis. A closer scrutiny of the desynchronosis phenomenon revealed that it was related to more than disruption of the usual sleep-wakefulness rhythm. An increasing number of facts also indicated that desynchronosis is not a specific set of symptoms associated with this type of disturbances. Desynchronosis is the constant "companion" of any disease, any impairment of health, any form of stress. Thus, the problem of this symptom complex advanced to the level of general medical, general biological problems.

More attention started to be given to rhythm disturbances, desynchronosis, in the 1960's because of the space flights, particularly orbital ones, when the usual, terrestrial succession of dark and light periods of the day (day and night) is disrupted.

Thus, there was gradual development of conditions for wider extension of the chronobiological (biorhythmological) approach to analysis of living systems. However, one should not think that such an approach (genuinely dialectical) to problems of biology (and physiology, as well as a number of other analogous disciplines) was accepted immediately and without a struggle by all representatives of modern natural science. In a number of cases, the requirement that time be considered as an effective factor in studies of the organism was not understood and, not infrequently, totally disregarded. The inertia of this attitude has not been eradicated to this day. But, while in the past (even relatively recently) disregard for problems of chronobiology played a negative role mainly in the theoretical aspect, at the present time its reflection in practice is growing increasingly perceptible. For

*Leman, G., "Practical Industrial Physiology," Moscow, Meditsina, 1967.

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expressly this reason, our science is presently faced with the task of expanding the front of biorhythmological research and making wide use of its findings in the national economy. Each step on this road is warranted. In this respect, one could hardly overestimate broad discussion of problems of biorhythmology.

The first section of this collection submits works dealing with analysis of some theoretical issues of biorhythmology and results of studying human biorhythms. The second section is concerned with the results of studying animal biorhythms. The works submitted in this section have the same methodological distinctions. In all of these studies, male Wistar rats weighing 180-200 g were the object of research. The animals were kept in groups (of 5-6 per cage) with the use of artificial illumination mode: 12 h of light (150-200 lux) and 12 h of darkness (less than 0.1 lux). The light was turned on at 0400 h. The temperature was kept at $22 \pm 1^\circ$ in the experimental room. The animals were given pellet feed at the end of the light period. Using physiological, morphological, histochemical, autoradiographic and biochemical methods, determination was made of circadian rhythms of rats, starting with general physiological parameters (spontaneous motor activity, body temperature, general exchange of gases), functional state of the hypothalamus--pituitary--adrenal system and ending with rhythms of cell reproduction and morphological state of systems that are renewed rapidly and slowly, as well as activity of some elements of nucleic and fluid metabolism in the organism.

Conditions to which rats were exposed with the use of different light modes

Group No	Duration of light (L) and dark (D) periods, h	Illumination during light period (lux)	Start and end of light period, time
1	12L+12D	150-200	0400-1600 hours
2	6L+18D	150-200	0900-1500 hours
3	6L+18D	15-20	0900-1500 hours

In addition, the objective of that study was to determine the patterns of change in the main features of circadian processes (level, amplitude, position of acrophases, shape of wave) in different systems of the organism with reduction of the light period, as well as of intensity of illumination. For this purpose, the animals were submitted to different illumination modes. The arbitrary designation of rat groups and main features of illumination conditions are listed in the Table.

The studies were conducted after 3-4-week adaptation of the rats to these conditions. The second and third groups of animals were examined on a reduced program.

This section also submits the results of studies of circadian rhythms of cellular reproduction in rats submitted to hypokinesia. The problem of hypokinesia is of interest to some branches of clinical medicine. The biorhythmological approach to this problem will help gain better understanding of the mechanisms of development of pathological states caused by hypokinesia and develop effective means of preventing them.

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UDC: 616.092;616.008.63

ADAPTATION IN THE LIGHT OF BIORHYTHMOLOGY

[Abstract of article by B. S. Alyakrinskiy]

[Text] The least studied aspect of the complex phenomenon of adaptation at this time is the set of changes in biological rhythms, particularly circadian ones. Analysis of this aspect of adaptation is of great theoretical and practical importance. Such analysis reveals that adaptation to new living conditions occurs through a struggle between opposing elements (resistance and alarm [anxiety]). A stable state of resistance does not rule out the unity of these elements, their constant struggle and constant resolution thereof. An element of deadaptation is always present in a state of marked well-being, and expressly this element is a mandatory prerequisite for progress, development and vitality. Such an approach to the phenomenon of biorhythmological adaptation opens up wide opportunities, both with respect to diagnostics and prognostics, in a number of areas of man's practical endeavors. References 70.

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ACROPHASE WANDERING ZONE

[Abstract of article by S. I. Stepanova]

[Text] Analysis is made of the phenomenon of wandering of acrophases of circadian biological rhythms, which signifies the instability of daily position of these phases on a 24-h scale. The segment of the 24-h scale, within which the position of the acrophase of some functional parameter varies from day to day over a period of many days is called its wandering zone. The width of the wandering zone is used to calculate the so-called coefficient of stability of acrophase position on the time axis. The phenomenon of fluctuation of numerical values of a functional parameter at each considered point on the 24-h scale is discussed in relation to the wandering phenomenon, analysis is made of factors that form this fluctuation, in particular the changes in level of circadian rhythms that are governed by weekly, monthly and seasonal periodicity. Literature is cited that confirms the seasonal changes in level, amplitude and position of acrophases of circadian biological rhythms of animals and man. The concept of "seasonal physiological desynchronization" is formulated, which is used to explain the seasonal periodicity of some diseases. Figures 6, tables 3; references 56.

UDC: 616.008.63

LINGUISTIC ANALYSIS OF HEART RHYTHM

[Abstract of article by A. D. Cherkay and Yu. A. Vlasov]

[Text] A procedure is described for linguistic analysis of sequences of EKG R-R intervals, which is based on isolating recurrent (matrix) sequences of R-R intervals referable to the ε -tube with specified ε . There is discussion of questions of formation of matrix sequences and their roots. Specific examples are offered of analysis of cardiac rhythm. Evaluation is made of the statistical significance of condensation of recurrent R-R sequences around the isolated matrix sequences. There

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is discussion of problems of modeling the rhythm of cardiac contractions. Figures 1, tables 3; references 8.

UDC: 616.008.63

MECHANISMS OF ADAPTIVE CHANGE IN CIRCADIAN RHYTHMS

[Abstract of article by V. I. Makarov]

[Text] Changes in circadian rhythms of man due to various stress agents are analyzed on the basis of the author's experimental results. It was demonstrated that adaptive changes can be manifested both in the form of less accentuation of rhythm and excessive accentuation, excessive constancy. Both variants of adaptive changes are deviations from the norm and indicative of development of a stress state. References 3.

UDC: 616.008.63

CIRCADIAN FLUCTUATIONS OF EKG INTERVALS IN MAN ON THE USUAL SLEEP AND WAKING SCHEDULE

[Abstract of article by A. A. Koreshkov]

[Text] Studies were made of circadian fluctuations of duration of EKG intervals in two healthy men isolated from natural light, kept on the usual sleeping and waking schedule. In both subjects, PQ, QRS and QRST intervals were shorter in the daytime than at 0600 hours. The obtained results also revealed that a decline of pulse rate in the first half of the night may occur without change in rate of excitation of atria and ventricles, i.e., without increase in duration of PQ and QRS intervals. Figures 3, tables 3; references 5.

UDC: 616.008.63

CIRCADIAN RHYTHM OF ACTIVITY OF LARGE-CELL NUCLEI OF THE RAT HYPOTHALAMUS AND ADRENAL CORTEX

[Abstract of article by Ye. I. Zubkova-Mikhaylova, Yu. P. Druzhinin†, N. D. Polyakova and L. M. Ponomarenko]

[Text] A study was made of circadian rhythm of activity of different elements of the hypothalamus--pituitary--adrenal system of Wistar rats kept under different illumination conditions, using histochemical and morphometric methods. Neurosecretory activity was characterized by varying circadian dynamics, depending on the length of the light period. Figures 7; references 25.

UDC: 616.008.63

EFFECT OF CHANGE IN PHOTOPERIOD AND ILLUMINATION ON CIRCADIAN RHYTHMS OF CELL REPRODUCTION IN THE RAT ESOPHAGEAL EPITHELIUM

[Abstract of article by Yu. A. Romanov, S. S. Filippovich and Yu. P. Druzhinin†]

[Text] A study was made of cell reproduction in the esophageal epithelium of Wistar rats kept in different modes of illumination using ³H-thymidine, every 3 h.

†Deceased

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Monophasic rhythms were demonstrated in number of DNA-synthesizing cells, dividing cells, dividing labeled cells and intensity of marking nuclei. Changes in photoperiod and illumination lead to desynchronization of both intrasystemic mechanisms of mitotic rhythm (endogenous desynchronization) and mechanisms that depend on lighting conditions (exogenous desynchronization). Figures 1; references 26.

UDC: 612.014.577.3

CIRCADIAN RHYTHM OF ACTIVITY OF DNAases AND STRUCTURE OF DNA IN RAT TISSUES

[Abstract of article by G. S. Komolova, V. F. Makeyeva, F. T. Guseynov, Ye. V. Belikova, I. A. Yegorov, Yu. P. Druzhinin† and G. N. Podluzhnaya]

[Text] A study was made of activity of acid and alkaline DNAases, as well as structure of supramolecular DNA (SM-DNA) in rat tissues over a 24-h period. Circadian changes in these parameters were demonstrated. The circadian curves of enzyme activity in the liver presented one peak and those of lymphoid tissues had two. The degree of periodicity of enzyme activity was related to intensity of DNA metabolism in tissue. The circadian rhythm of SM-DNA structure in lymphoid tissues, like synthesis and quantitative DNA content, is described by a single-peak curve. However, the positions of the corresponding extremums on the curves are shifted in time. There is reason to believe that the circadian change in DNAase activity is related predominantly to catabolic metabolism of DNA, while the state of DNA is related to anabolic aspects thereof. Figures 3; references 33.

UDC: 616.008.63

CHANGES IN THE ORGANISM'S SUPPLIES OF NUCLEOSIDES---THYMIDINE AND DEOXYURIDINE--IN THE COURSE OF A 24-HOUR PERIOD

[Abstract of article by V. F. Mikhaylov, Yu. P. Druzhinin,† Ye. Yu. Moskaleva and T. A. Fedorova†]

[Text] Studies were made of the course in time of excretion of free deoxynucleosides of the pyrimidine class-thymidine and deoxyuridine---in urine of rats kept under different illumination modes. Nucleoside excretion was higher during the dark period than the light. A reduction of the light period did not reliably alter the output of these compounds per day; with decrease in illumination there was a 2.5-fold increase in 24-h excretion of deoxyuridine. Restriction of rat mobility led to different changes in the stock of deoxyuridine as a function of the base level in control animals. Figures 2; references 11.

UDC: 616.008.63

CHANGES IN MANGANESE CONCENTRATION IN RATS IN THE COURSE OF THE DAY [24 HOURS] AS A FUNCTION OF INTENSITY AND MODE OF ILLUMINATION

[Abstract of article by V. N. Reushkin, N. P. Roslyakov and A. M. Samonov]

[Text] Experiments on rats revealed that the circadian curves reflecting changes in manganese concentration in the course of a day in the liver and thymus differed in accordance with illumination mode. During adaptation of animals to a change in

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illumination conditions, the change in these periodic processes occurs at different rates. Tables 1; references 7.

UDC: 616.008.63

STUDY OF CIRCADIAN RHYTHMS OF CELLULAR REPRODUCTION IN HYPOKINETIC RATS

[Abstract of article by Yu. A. Romanov, S. S. Filippovich, E. T. Ostroushko, L. I. Stepanova, Ye. A. Kovalenko and E. A. Kamenetskaya]

[Text] Studies were made of circadian rhythms of number of DNA-synthesizing and dividing cells, intensity of DNA synthesis, duration of premitotic period of the mitotic cycle in parenchymal and stromal cells of the liver, in cells of the cryptal epithelium of the small intestine of rats submitted to experimental hypokinesia for 34 days. It was demonstrated that, under such conditions, there is a drastic decrease in number of DNA-synthesizing and dividing hepatocytes, and inhibition of rate of DNA synthesis in them. There was considerably less marked reduction of stromal cell reproduction in the liver, and none was demonstrable in the cryptal epithelium of the small intestine. Consequently, the rapidly renewed cellular system is more resistant to hypokinesia than one that is slowly renewed. At the same time, in none of the examined tissues did hypokinesia lead to appreciable disturbances of phasic structure of circadian rhythms of cellular reproduction. This indicates that there is no direct connection between periodicity of cell division and rhythm of motor activity of animals, which is apparently not among the main time sensors for processes of cellular proliferation. Figures 5, tables 1; references 54.

UDC: 616.008.63

SOME PATTERNS OF CHANGE IN CIRCADIAN RHYTHMS WITH DIFFERENT LIGHTING MODES

[Abstract of article by Yu. P. Druzhinin,† G. N. Podluzhnaya, G. P. Rodina and V. M. Seraya]

[Text] Results are submitted from a study of the "phase map" of several physiological and morphological parameters, periodicity of activity of the hypothalamus--pituitary--adrenal system, rhythms of cellular reproduction and nucleic metabolism in Wistar rats submitted to different modes of illumination. It was established that there is the same reaction to both a decrease in light period and in illumination level. Figures 3; references 11.

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PSYCHOLOGY

THEORETICAL AND APPLIED RESEARCH IN PSYCHOPHYSIOLOGY OF SPORTS ACTIVITIES

Kazan' TEORETICHESKIYE I PRIKLADNYYE ISSLEDOVANIYA PSIKHOFIZIOLOGII SPORTIVNOY DEYATEL'NOSTI in Russian 1979 (signed to press 15 Oct 80 [sic]), pp 2,....

[Annotation and table of contents from book "Theoretical and Applied Research in Psychophysiology of Sports Activities" edited by Docents A. P. Kashin and V. M. Shadrin, published by decree of the Editorial and Publishing Council of Kazan' University, Izdatel'stvo Kazanskogo universiteta, 500 copies, 101+ pages]

[Text] This publication sheds light on theoretical and applied aspects of complex studies of individual psychological differences in sports. There is discussion of some theses of general theory of sports activity. There is reflection of the psychophysiological distinctions of high-class athletes--fighters, track and field athlete-sprinters, sailboat sailors and mountain climbers. This collection is intended for researchers in psychology, physiology and pedagogics, as well as specialists and trainers working with high-class combined teams.

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EMOTIONS AND RECREATION OF ATHLETES

Moscow EMOTSII I OTDYKH SPORTSMENA in Russian 1980 (signed to press 8 Oct 80)
pp 2-3, 64

[Annotation, beginning of article and table of contents from book "Emotions and Recreation of Athletes", by Roman Stepanovich Demeter ("News in Life, Science and Technology, 'Physical Culture and Sports' Series," No 11), Izdatel'stvo "Znaniye", 55,300 copies, 64 pages]

[Text] The author acquaints readers with original methods and procedures for independent control of emotional states of athletes to remove tension and fatigue. The pamphlet offers advice that can also be followed by individuals who are not engaged in sports in order to eliminate emotional tension that arises in the course of their work.

Emotions of Athletes

It is an important national task to strengthen and develop the physical and spiritual potential of the Soviet people. The Soviet system of physical education offers vast opportunities for millions of people to engage in sports, develop physically and strengthen health. Sports bring joy, inculcate a sense of collectivism and are instrumental in harmonious development of the personality. This applies if we discuss sports in general. But what about high achievement sports, major sports? Do they always bring joy, can an athlete always show what he is capable of? On what does this depend?

There are numerous outstanding athletes characterized by composure, ability to aim at victory and overcome psychological barriers. Emotional stability is inherent in them. In a sports competition they display enormous will power, inexhaustible spiritual and physical strength. For them, competition is a festive occasion.

V. Alekseyev, a veteran of heavy athletics and frequent world champion, is an example, first of all, of emotional stability of athletes who constantly show high athletic achievement. The ability to collect his strength and aim at victory is inherent in him. Among the young weight-lifters, these traits are prominent in Yu. Vardanyan, who set a number of world records at the 7th National Games of the USSR and at the 22d Olympics. Heavy athlete D. Rigert broke records more than 60 times....

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SELF-REGULATION AND PREDICTION OF SOCIAL BEHAVIOR OF THE INDIVIDUAL

Leningrad SAMOREGULYATSIYA I PROGNOZIROVANIYE SOTSIAL'NOGO POVEDENIYA LICHNOSTI
in Russian 1979 (signed to press 14 Nov 79) pp 2-5, 263-264

[Annotation, foreword and table of contents from book "Self-Regulation and Prediction of Social Behavior of the Individual" edited by V. A. Yadov, Institute of Socio-economic Problems, USSR Academy of Sciences, Izdatel'stvo "Nauka", 5100 copies, 264 pages]

[Text] In this monograph, analysis is made of the results of a many-year study conducted by a team of Leningrad sociologists and social psychologists, which deals with motivation of the personality, the role thereof in self-regulation of social behavior, objective determination of motivation and its reflection in consciousness. The study is based on the hypothesis of structure of value orientations and social sets of the personality, which form the disposition system. There is discussion of the problem of correlation between conscious desires of the personality and its real actions, as well as prognostic value of information about a personality's dispositions for predicting certain forms of people's social behavior. Studies were pursued of the various distinctions of dispositional regulation of behavior of 1000 Leningrad engineers. This book contains a wealth of methodological material and describes in detail the main investigative procedures that can be used to study the personality. The book is intended for specialists in the field of philosophy, sociology, psychology and pedagogics, as well as all those interested in problems of personality and human behavior.

Foreword

The offered work was initially conceived as a complex sociological and sociopsychological study of regulatory functions of value orientations of the personality.* However, as we developed the research program, we arrived at the conclusion that value orientations are an element of a more complex, hierarchically organized structure of the personality's relations to its living and working conditions.

There is an abundant literature dealing with regulatory functions of various states of personality readiness for a specific mode of action. They are given different names--vital position, orientation of interests, value orientation, social set, subjective attitude, dominant motivation, subjective meaning imparted to actions, etc. All this is nothing other than disposition of the personality, fixed in its

*See: "The Personality and Its Value Orientations," Moscow, No 1, 1969
(INFORMATSIONNY BYULLETEN' IKSI AN SSSR, No 4, 19).

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social experience of predisposition to perceive and assess conditions of activity, as well as to act in a specific manner under these conditions.

It is reasonable to assume that personality dispositions are not chaotic, but that they form a system. This study was based on expressly this idea.* Investigation of the distinctions of disposition structure and its properties, objective and subjective conditions of its formation and, finally, its correlations with actual [real] social behavior of the personality constitute the main theoretical content of this book.

From the standpoint of practical feasibility of predicting social behavior, the authors' objective was to demonstrate the "prognostic value" of information about different states of a subject's predisposition for specific behavior under specified conditions. The latter is quite important also for the reason that subjective evaluation data are used extensively to gain information about the real behavior of people in the foreseeable future. Yet the extent to which such forecasts are well-grounded is still unclear, let alone the comparative value of diverse methods of obtaining such information.

A sampling group of engineers numbering more than 1000 people, working in planning and design organizations of Leningrad, were submitted to examination. From the standpoint of the main objectives of the research plan, they did not emerge as a social and professional group, but as a set of subjects whose activities were analyzed in different aspects.

At the same time, problems of organizing engineering work and the personality of the planning engineer, on whose active vital position depends to a significant extent the immediate integration of science and industry, is a subject that it is exceptionally important to give special consideration. The authors, who are well-aware of its importance, devoted a special book to the subject.** Here, however, we shall deal with such questions only to the extent that it is necessary to discussion of the main subject--regulation and self-regulation of social behavior of the personality [individual].

* * *

The following participated actively in different stages of this study: V. A. Yadov (head of research project), V. V. Vodzinskaya, I. S. Kon, A. A. Kissel', G. I. Saganenko and A. P. Sopikov in elaborating the general program; V. A. Yadov

*See: Yadov, V. A., 1) "Dispositional Regulation of Social Behavior of the Personality," in "Metodologicheskiye problemy sotsial'noy psikhologii" [Methodological Problems of Social Psychology], Moscow, 1975; 2) "The Personality as the Object and Subject of Social Relations," in "Sotsiologiya i Sovremennost'" [Sociology and Modern Times], Moscow, Vol 1, 1977; Yadov, V. A., and Vodzinskaya, V. V., "Internal Regulation of a Subject's Social Behavior," in "Problemy sotsial'noy psikhologii" [Problems of Social Psychology], Tbilisi, 1976.

**See: "Sociopsychological Portrait of an Engineer. From Results of a Survey of Engineers in Planning and Designing Organizations of Leningrad," edited by V. A. Yadov, Moscow, 1977.

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(labor), V. V. Vodzinskaya (recreation), A. A. Semenov (psychological tests), G. I. Saganenko (determination of general requirements as to validation and reliability of procedures) in the design of methods for the main sections of the study, as well as V. N. Kayurova, A. A. Kissel', V. A. Losenkov, Ye. E. Smirnova and A. A. Sopikov, who developed some of the methods; V. V. Vodzinskaya, L. D. Doktorova, L. Ye. Kesel'man, V. S. Magun, V. P. Rukavishnikov, G. I. Saganenko, A. A. Semenov, Ya. Tamm and V. A. Yadov in development of methods for analysis of data, design of summary indicators [parameters] and typological procedures; L. N. Veksha and L. Ye. Kesel'man (supervisors of field studies), L. V. Bozrikova, G. F. Krasnonosenko, G. A. Pozharskaya and S. P. Khrshanovskaya in gathering and primary analysis of data; Ye. I. Ignat'yeva, in preparing the text for publication.

At the preliminary stage, the data were processed at the Computer Center of the ISI [Construction Engineering Institute] of the USSR Academy of Sciences using the programs of V. I. Molchanov and A. R. Tolstova, and at the Computer Center of Tartu University using the programs of E. Tiyt and M. Tooding. Final processing was performed at the Computer Center of Estonian Radio and Television using the programs of L. Vykhandu, A. Laumets and A. Laumets with the participation of Ya. Tamm, as well as the Computer Center of ISEP [expansion unknown], USSR Academy of Sciences, by a team headed by I. V. Klokachev and V. T. Perekrest, consisting of O. N. D'yakonova, D. V. Igolkina, Zh. I. Panchuk, P. V. Suvorov, T. V. Khachaturova and Z. V. Shtennikova.

* * *

Different sections were written by the following authors: Chapter I, § 1, 3, 4--V. A. Yadov, § 2--A. A. Semenov; Chapter II--V. V. Vodzinskaya, V. N. Kayurova, A. A. Kissel', G. I. Saganenko, A. A. Semenov, V. A. Yadov; Chapter III, § 1--L. V. Bozrikova, G. I. Saganenko, A. A. Semenov, V. A. Yadov, § 2--V. A. Yadov, § 3--A. A. Semenov, V. A. Yadov, § 4--V. V. Vodzinskaya, V. A. Yadov; Chapter IV, § 1--G. I. Saganenko, V. A. Yadov, § 2--L. V. Bozrikova, A. A. Kissel', § 3--V. N. Uzunova; Chapter V--V. S. Magun; Chapter VI, § 1, 3--V. A. Yadov, § 2--G. I. Saganenko, V. A. Yadov; Appendices: A) Description of Methods--V. V. Vodzinskaya, V. N. Kayurova, A. A. Kissel', V. A. Losenkov, G. I. Saganenko, A. A. Semenov, Ye. E. Smirnova, V. A. Yadov; B) System of Main Procedures for Preparation and Analysis of Data in a Complex Multistep Study--L. D. Doktorova. L. D. Doktorova compiled the "Table [Index] of Main Parameters [signs, tags] Used in This Book."

The team of researchers expresses their profound gratitude to those who participated constructively in discussions of the program and investigative methods: G. M. Andreyeva, Yu. V. Vooglayd, O. I. Genisaretskiy, M. Gomelauri, V. M. Kvachakhiya, V. V. Kobanovskiy, V. N. Kudryavtsev, Yu. N. Kulyutkin, M. Lauristin', N. S. Mansurov, Sh. A. Nadirashvili, N. F. Naumova, V. B. Ol'shanskiy, G. V. Osipov, Ye. V. Osipova, I. M. Paley, F. Pataki, G. S. Sukhobskaya, Z. I. Faynburg, E. Khaan, O. I. Shkaratan, G. P. Shchedrovitskiy and comrades who commented on the text of this book--V. B. Golofast, A. A. Gorbakov, S. I. Golod, B. Z. Doctorov, Ye. S. Kuz'min, I. I. Leyman, K. Muzdybayev and B. D. Parygin.

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SOCIOPSYCHOLOGICAL CLIMATE IN A GROUP: THEORY AND INVESTIGATIVE METHODS

Moscow SOTSIAL'NO-PSIKHOLOGICHESKIY KLIMAT KOLLEKTIVA: TEORIYA I METODY IZUCHENIYA in Russian 1979 (signed to press 28 Nov 79) pp 2-4, ...

[Annotation, foreword and table of contents from book "Sociopsychological Climate in a Group: Theory and Investigative Methods" edited by Prof Ye. V. Shorokhova, doctor of philosophical sciences, and O. I. Zotova, candidate of psychological sciences, Izdatel'stvo "Nauka", 5000 copies, 162+ pages]

[Text] This work deals with theoretical and experimental investigation of the sociopsychological climate in a group. It describes various approaches to determination of the sociopsychological climate, discusses the conditions under which it is formed and analyzes the status of this problem in Soviet social psychology and abroad.

Foreword

The tasks put by the Party in the fields of economics, politics and communistic training require constant refinement of control of the entire national economy and guidance of each work group. The practical implementation of these tasks would be impossible without theoretical interpretation thereof, without following the theoretical recommendations in the practical building of communism. Representatives of the social sciences must also make their contribution to this national cause.

Comrade L. I. Brezhnev stated: "It is obvious that the tasks put to our social science can only be performed if it is very closely related to life. Scholastical theorizing could only slow down our progress. It is only the link with practice that can raise the effectiveness of science, and this is one of the focal problems of our times."*

Worker groups are playing an increasing role in solving the main economic, sociopolitical and educational problems facing our people. They "participate in the discussion and solution of national and social affairs, in planning production and social development, in training and placement of personnel, in discussion and solution of problems of management of enterprises and institutions, improvement of working and living conditions, use of funds assigned for development of industry, as well as social and cultural measures and material incentives."

*"Proceedings of the 25th CPSU Congress," Moscow, Politizdat, 1976, p 73.

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"Worker groups develop socialist competition, they are instrumental in disseminating progressive work methods, strengthening work discipline; they educate their members in the spirit of communistic ethics; they are concerned about improving their political awareness, sophistication and professional qualifications."*

This collective book deals with pressing problems of immediate practical relevance---the study of the sociopsychological climate in worker groups.

The participating authors are scientists on the staff of the Institute of Psychology, USSR Academy of Sciences, and other social psychology centers of the Soviet Union (Kostroma, Yaroslavl', Leningrad, Kursk), who have tried to reflect the status of research on these problems at the current stage of development of sociopsychological science in the USSR and abroad. It offers a system of concepts of theory of sociopsychological climate, and explores the different factors thereof. There is a special section of the collection that deals with descriptions of methods of investigating the sociopsychological climate.

The lack of generalizing literature on problems of social and psychological climate, the complexity and insufficient development of these problems have resulted in a diversity of approaches and points of view concerning the phenomena under discussion, and this was reflected in this collection.

The team of authors expresses its hope that the book will be interesting and useful to specialist psychologists, philosophers, as well as supervisors of industrial groups, for whom formation of a beneficial sociopsychological climate is a pressing task.

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*"Constitution (Main Law) of the Union of Soviet Socialist Republics," Moscow, Politizdat, 1977, pp 7-8, article 8.	

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PSYCHOPHYSICS OF SENSORY SYSTEMS

Moscow PSIKHOFIZIKA SENSORNYKH SISTEM in Russian 1979 (signed to press 17 Oct 79)
pp 2-8, 199

[Annotation, introduction by Yu. M. Zabrodin and table of contents from book "Psychophysics of Sensory Systems", edited by B. G. Lomov and Yu. M. Zabrodin, Institute of Psychology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 3500 copies, 199 pages]

[Text] This collection deals with problems of psychophysical studies of sensory processes. It discusses theoretical aspects of such research, offers an idea about the main scientific trends that have recently appeared in psychophysics, discusses some problems of experimental methods and procedures, and submits the results of research conducted in this field. The book is intended for specialists concerned with experimental and applied psychology, physiologists, biophysicists, physicians, undergraduate and graduate students in the relevant specialties.

Introduction

At the present time, psychophysics is one of the branches of psychological science that is being developed the most intensively in the USSR. Its purpose is to investigate the main patterns of sensory mental reflection, primarily of the structure, content and properties of mental images as related to the objective properties of external objects and events that are the actual object of reflection. In other words, psychophysics is concerned with the relationship of reflection to what is reflected, "it takes the subjective as a characteristic of mental reflection by comparison thereof to the physical properties of reflected objects" (B. F. Lomov, "The Systems Approach in Psychology," VOPROSY PSIKHOLOGII, No 2, 1975, p 43). However, the real relations between the subject and outside world shows us immediately that any "linear" or "flat" approach to analysis of mental phenomena, including graphic reflection, has limitations. Awareness of this circumstance suggests that it is necessary to turn from former linear and deterministic conceptions to the principle of systemic determination of the mind, the need to disclose the real psychological mechanisms of control of behavior and activity of subjects.

It is extremely important from this vantage point to consider the real role and function of a mental image as the result of mental reflection or regulator of man's behavior and activity. Unfortunately, there has not yet been proper development in worldwide or Soviet science of the very fruitful ideas of the outstanding Soviet psychologist, B. G. Anan'yev (which he advanced as far back as the early 1960's) concerning the high significance of processes of sensory reflection in the overall

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system of cognitive and regulatory mental processes. If psychophysics does not wish to remain a self-contained specific branch of psychology, it will inexorably "proliferate" into allied branches of psychology, and not only psychology, but neurophysiology, physics and cybernetics, being enriched by their methods, ideas and findings and, in turn, enriching these allied branches of science.

This tendency toward expanding and strengthening correlations between psychophysics and other sciences in the system of allied scientific disciplines, toward revising its own subject and internal range of problems on the basis of a stronger methodology and new paradigms, is a typical feature of modern Soviet and worldwide psychophysics. This is associated with the emergence of a number of new directions, theoretical and experimental, basic and applied branches thereof. The desire to consider the object of research in a systemic way, as well as to organize the internal categorial system, systematize the range of problems and develop new investigative methods, is outlining the route of future expansion of psychophysics and directions of its development in the immediate future.

It is opportune to mention here some new and latest directions which, in our opinion, determine the typical features and outline of modern psychophysics.

First of all, we refer to development and deepening of research in the area of general and special, concrete methodology of psychophysics, development of theory of methods of investigation, analysis, interpretation and application of accumulated knowledge (principles, conceptions, laws, patterns, facts, etc.). One of the reasons for this is the need, in view of the above-mentioned quantitative growth in areas of research, to preserve the qualitative specificity of the object studied and consolidate the depth and precision of analysis that are inherent in psychophysics as one of the oldest branches of psychology, which have armed themselves with the experimental method of investigation.

Work in the area of theoretical analysis of research methods and procedures is closely linked with this direction. We refer to the development of general theory of psychological measurements, refinement of the formal apparatus that would be suitable for describing the phenomena and processes studied, development of history and theory of experimental methods in psychology and psychophysics, logical and psychological validation of research strategies (combined dynamic procedures extending in time; adaptive controlled experiments, etc.). The main idea in this direction is, in our opinion, to develop the qualitative and quantitative system, expand and verify the system of models and mathematical descriptions of psychological mechanisms of the processes in question.

Another direction is characterized by advancement toward increasing use of data and methods from psychophysiology of sensory systems and neurophysiology. There are two main groups of problems determining this direction. The first is related to the search for additional reliable indicators of mental activity, which would serve as a reliable enough support for the researcher in verifying psychophysical hypotheses and models, including such checks in the course of an actual experiment. The second group of problems referable to this direction is, as we see it, more theoretical: comparative analysis of psychophysical hypotheses and data, as related to results of neurophysiological studies. And, as we have repeatedly mentioned, one must bear in mind the rather specific, nonlinear nature of relations between nervous processes, mechanisms of function of systems of the brain and mental processes, psychological mechanisms of the phenomena under study.

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While nervous processes constitute a complexly organized dynamic system, mental processes should be viewed as a sort of "supersystem" [or suprasystem]. In other words, the relationship between mental and nervous phenomena is a relationship between two complex systems that are not necessarily organized in a similar way. It is our assumption that investigation of the nature of neurophysiological "restrictions" could yield a beneficial result, if we compare them to borderline phenomena and mental characteristics. For this reason, we believe that one should expect to discover new and interesting facts and patterns in the area of such comparative analysis of expressly psychophysical phenomena and their neurophysiological basis.

The next direction, which is important in our opinion, refers to investigation of dynamic properties of psychophysical phenomena and processes, which have been little studied thus far. Paradoxically enough, while scientist-psychologists are well aware of the processual nature of mental phenomena, they are not concerned (with rare exceptions) with theoretical and experimental research on time, dynamic and changing characteristics of man's work in solving psychophysical problems. The same applies, in particular, to setting up research procedures and methods of processing data.

In recent years, two beneficial lines of work have emerged in this direction: investigation of the dynamics of sensory characteristics of the observer, dynamics of parameters of a sensory process--on different levels and scales and of different origin; psychophysical analysis of the distinctions of reflection and work with dynamic signals. It must be borne in mind that psychophysics has strived in its experimental procedures to deal essentially with so-called discrete problems: the alphabet of stimuli was limited to a set of discrete signals (individual tests, experiments), while the results of the work were assessed in a discrete set of responses. Of course, psychophysical investigation of continuous problems is incredibly more complex: strong theoretical arguments and ideas are needed, that would make it possible to separate in the analysis sensory, extrasensory and effector (regulatory) aspects of a process, in the manner that psychophysical theory makes it possible to do in studying the above-mentioned discrete problems.

Finally, investigation of individual distinctions of man's work in solving psychophysical problems constitutes another important direction. This direction is valuable to us not only because it discloses additional opportunities for differential evaluation of the observer's capabilities, to define the typology of individual reactions, although such work could also be quite productive if the latest advances of psychophysics are used. It is also of great scientific importance to study individual characteristics and strategies of solving psychophysical problems, which could define the range of the numerous individual variations and specifics of movement (expression) of the process in this range. The very nature of research acquires, so to speak, two levels: a search is made of what is common to individual variations and individual invariants as the specific characteristics of individual execution. Here we find that it is possible to "double" check the theoretical theses: there is verification of the results and conclusions of general theory on a multitude of data and a check of the corollaries of general theory by means of comparing the theoretical description of a process obtained by defining more concretely the general theory (or model) to the experimentally observed results.

Such is the brief description of promising directions of development of psychophysical research. Of course, the foregoing does not mean that traditional

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psychophysical research will cease to develop. We find that there is also further deepening of work in these directions: research methods are becoming more refined and sophisticated, progress is continuing in the area of investigation of reflection of complex signals, theoretical descriptions of processes of detection, discrimination and evaluation of signals are becoming more complex and gaining greater depth.

This book is an attempt to shed light on some new directions in psychophysics of sensory systems in the immediate future. It was prepared by the Laboratory of Psychophysics of the Institute of Psychology, USSR Academy of Sciences; the authors are on the staff of this institute, and they also include our Soviet and foreign colleagues.

The collection consists of three sections: the first deals with primarily theoretical research; the second discusses problems of methods of psychophysics; the third submits data obtained from experimental research.

The first section begins with an article by Yu. M. Zabrodin, V. N. Nosulenko and A. P. Pakhomov, "Dynamic Aspects of the Detection Process," in which they sum up the results they obtained from studies of theoretical approaches and phenomenology of the dynamics of sensory processes of man's discovery and discrimination of signals. The purpose of this article is to draw the attention of psychophysicists to this problem, point to the need to develop new approaches, new theoretical conceptions and the need to develop adequate methods of experimental analysis of dynamic phenomena in psychophysics (including a search for suitable methods of processing data).

The article of Ye. Z. Frishman deals with theoretical validation and search for strong argumentation in favor of the hypothesis of effects of mechanisms and levels of activation on dynamics of psychophysical parameters. This idea can be viewed as one of the first steps on the road to analysis of individual typological distinctions of the observer.

The article by D. M. Green et al. (United States), "Detection and Identification of Clear Tones in Noise," submits the results of verification of a theorem that relates data obtained from experiments dealing with detection of tonal signals against the background of noise to the parameters of man's identification of acoustical signals of different frequencies. It was demonstrated that the conclusions of the theorem are valid in cases when it is valid to assume that input signals are orthogonal (in particular, when the difference between frequencies of identified signals is greater than the critical band for hearing).

The article of H. G. Gaissler (GDR) deals with the main lines of research in modern worldwide psychophysics and some new advances in this field. It offers an exemplary classification of the main approaches and demonstrates the possibility of developing some of them in different branches of psychophysics. H. G. Gaissler demonstrates convincingly the fruitfulness of systems analysis of psychophysical phenomena.

In the next two articles of the theoretical section, there is discussion of the possible psychophysiological and neurophysiological mechanisms and bases of psychophysical phenomena. A. N. Lebedev et al. undertake a fruitful attempt, in our

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opinion, to validate some of the laws of psychophysics on the basis of analysis of the properties of electrical activity of the brain. These findings are based on a model of electrical activity of neurons and neuronal nets, which they are developing, which considers residual (oscillatory) phenomena in the system of connected neurons.

N. I. Chuprikova discusses the possible sources of the false-alarm reaction and mechanisms of realization of the observer's criterion; she describes three hypothetical mechanisms that provide for maximization of the probability of detection of a signal: guessing, mechanisms of pretriggering integration, second-signaling system conscious differentiation between sensations, with respect to quality and quantity. She demonstrates the specificity of the mechanism of the false-alarm reaction, the nature of which cannot, in her opinion, be related to simple, unorganized neuronal "noise."

The second section on methods consists of two articles.

The article by K. V. Bardin, "Instructions in Psychophysical Experiments," offers some beneficial methodological instructions on planning and organizing psychophysical experiments. He explains how one can eliminate the undesirable influence of incomplete or inaccurate instructions on the end results of experiments.

Yu. A. Indlin shows how one can use the energetic model he proposes of signal discrimination by man for qualitative evaluation of some parameters of observer work with the use of the method of constants.

The third section of this collection contains the results of experimental research.

Two articles, by G. S. Shlyakhtin and I. Marinova, and L. Mitrani (People's Republic of Bulgaria), deal with evaluation of the time characteristics of perceived and discriminated signals. In the first of these articles, there is experimental verification of a model of discrimination of short periods, and it is shown that when working with different intervals there may be a change in discrimination mechanisms from evaluation of time of formation of a sensory image to analysis of amount of sensory information per unit time. In the second article, evaluation of signal duration as a function of its physical time and magnitude of standard was obtained; it was found to be an exponential function of physical time of the observed interval as related to the standard interval.

The article by K. V. Bardin, Yu. M. Zabrodin, A. M. Ivanitskiy and L. V. Matveyeva submits the results of an experimental study of sensory and extrasensory factors of detection and discrimination of signals in the presence of some forms of mental disorders. It was demonstrated that certain disturbances of the sensory perceptive process are present in schizophrenics and psychopathic personalities. There is also discussion of the distinctions involved in using methods of classical and modern psychophysics to study sensory processes in the presence of pathology.

The last article in this section is by A. P. Chernyshev and V. G. Zazykin, who demonstrated experimentally the stochastic and nonlinear nature of reflection of physical parameters of a signal in problems of the continuous type: tracking random and harmonic signals.

Thus, the articles in this collection cover a wide range of trends in modern psychophysics, and they may give the reader an idea about new problems and some of the

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new findings made in recent years in psychophysics of sensory systems. The ideas and experimental data submitted in this collection may be of interest to specialists in the field of psychophysics and psychophysiology of sensory systems and processes, as well as in experimental and engineering psychology.

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SUMMARY OF CONFERENCE ON PROBLEMS OF PSYCHOLOGISTS AT INDUSTRIAL ENTERPRISES

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 14: PSIKHOLOGIYA in Russian No 3, Jul-Sep 81 (manuscript received 3 Mar 81) pp 61-62

[Article by Vladimir Sergeyevich Ageyev, candidate of psychological sciences, junior scientist in Department of Social Psychology, Psychology Faculty of MGU (Moscow State University), and Yekaterina Mikhaylovna Dubovskaya, senior laboratory technician, Department of Social Psychology, Psychology Faculty, MGU]

[Text] A scientific and practical conference convened on 16 and 17 February in the Psychology Faculty of Moscow State University [MGU], which dealt with problems related to the work of a psychologist at an industrial enterprise. The conference was organized by the Department of Social Psychology of this faculty and the Sociology Laboratory of the Tiraspol'skiy Garment Association imeni 40th Anniversary of the Komsomol. Representatives of some industrial enterprises of Moscow, members of the department of engineering psychology and industrial psychology, graduates from the faculty of psychology working in industry, as well as faculty students specializing in social psychology were also invited to participate in this conference.

In his opening remarks, Prof A. A. Bodalev, dean of the Psychology Faculty, stressed the urgent need of increasing introduction of the results of psychological research into practice; he also outlined the main directions of applied studies in the light of the decisions of the 26th CPSU Congress. The paper of A. F. Pavlova, deputy director of the Tiraspol'skiy Garment Association for management, social development and personnel, offered an exhaustive description of the achievements of this enterprise, both with regard to technical-economical indicators and social development of the personnel of the association. This association, which is headed by V. S. Solov'yeva, Hero of Socialist Labor, has been in first place for 110 successive quarters in the All-Union competition for this industrial sector. A. F. Pavlova also noted that the achievements of the enterprise were largely attributable to applied investigations and practical recommendations prepared by the staff of the enterprise's sociology laboratory, which is manned by four psychologists (three of whom are graduates from our faculty).

V. V. Chichilimov, head of the association's sociology laboratory, outlined the main direction of work by the laboratory staff and the main tasks to further upgrade the performance of the sociopsychological service at industrial enterprises. He acquainted the audience with a method of actively involving young people in industrial management by means of temporary appointment (for 1 day per month) to responsible positions, up to shop supervisors. The speaker demonstrated convincingly the enormous educational potential of such "business games." In conclusion, V. V. Chichilimov appealed to the scientific psychological community for

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continued coordination in defining the place and functions of a psychologist at an industrial enterprise, and he also praised the professional training of graduates of the Department of Social Psychology, Psychology Faculty of MGU.

The next speeches by the staff of the sociology laboratory (V. M. Kashina, I. R. Rudkovskaya, A. G. Dumitrashko) defined some of the special "targeted programs": research on adaptation of young workers to a modern enterprise, the problem of creating "sociopsychological comfort," some aspects of work on problems of interpersonal perception, particularly in the system of management and subordination.

After the speeches of guests from Tiraspol', the floor was given to the staff of the faculty. In their speeches, I. G. Kokurina, K. Ye. Danilin and O. N. Chernysheva touched upon a number of extremely important problems confronting clinical psychologists in a modern industrial enterprise: sociopsychological study of motivational structure of the personality, determination of functions of the clinical psychologist, formulation of tasks for the sociopsychological services, interaction between social psychologists and industrial psychologists in solving complex problems.

In summing up the outcome of the first day of the conference, Prof G. M. Andreyeva, head of the Department of Social Psychology, discussed in detail pressing problems of training psychologist students for work at an industrial enterprise. In his paper, several specific steps were proposed to improve the quality of training of future clinical psychologists: transfer of industrial practice to the fourth year, preliminary vocational guidance of students, participation of prominent clinical psychologists in working out and conducting different specialized practical classes, etc.

The second day of the conference was organized in the form of "round table discussions." There were two focal issues: the first, discussion of the collective monograph by the staff of the sociological laboratory at the Tiraspol' Association* and elaboration of a plan and prospects of future collaboration of the Department of Social Psychology with the sociological laboratory of the Tiraspol' Association.

The staff of the department praised the monograph of the Tiraspol' group. It was noted that this book was a good example of the genre of a scientific and practical monograph seldom encountered in psychological literature (A. I. Dontsov, L. A. Petrovskaya); it was stressed that the book is very important to dissemination of the progressive knowhow of the sociological service at the Tiraspol'skiy Garment Association (I. G. Kokurina, A. U. Kharash). At the same time, several constructive comments were made, in particular, about the need for stricter definition of the concepts used and separation of sociopsychological, sociological and general psychological aspects in the study of specific practical problems (G. M. Andreyeva); it was also indicated that it is imperative to improve the validity of research results (K. Ye. Danilin, Yu. M. Zhukov, N. N. Bogomolova). Wishes were also expressed concerning new directions of scientific applied research in the laboratory (T. Yu. Bazarov, V. S. Ageyev).

*Solov'yeva, V. S., Kashina, V. M. and Chichilimov, V. V., "All About Us and Our Group," Kishinev, 1980.

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In the course of the discussion, there was definition of the main directions of future collaboration of the two groups: regular exchange of information about research in progress, periodic meetings of representatives of both groups to discuss pressing theoretical and practical problems, scientific-methodological and consultant assistance on the part of the Department of Social Psychology.

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PSYCHIATRY

PSYCHOPHARMACOTHERAPY: CONCISE HANDBOOK FOR PRACTICING PHYSICIANS

Yerevan PSIKHOFARMAKOTERAPIYA: KRATKOYE RUKOVODSTVO DLYA PRAKTICHESKIKH VRACHEY
in Russian 1980 (signed to press 1 Feb 80) pp 2-9

[Annotations, foreword by Prof G. Ya. Avrutskiy, head of the Department of Psychopharmacology, Moscow Scientific Research Institute of Psychiatry, RSFSR Ministry of Health, and table of contents from book "Psychopharmacotherapy--A Concise Handbook for Practicing Physicians", by Georgiy Avetisovich Burnazyan, edited by Prof E. S. Gabrielyan, doctor of medical sciences, corresponding member of the Armenian Academy of Sciences, Izdatel'stvo "Ayastan", 3000 copies, 344 pages]

[Text] This book lists in a systematized form the most popular psychotropic agents, drugs to treat parkinsonism and other products that correct the side-effects and complications that occur from psychopharmacotherapy. Much attention is devoted to the distinctions of clinical efficacy of different products, their place and importance in emergency psychiatric care, combined therapy, pediatric practice and general medicine. The general section deals with current conceptions of the mechanisms of action of psychotropic agents and factors directly involved in their effects. It is intended for psychiatrists, neuropathologists and other specialists in clinical medicine. Figures 12, tables 4; references 840.

This book was published at the recommendation of the Pharmacological Committee of the USSR Ministry of Health, Scientific Medical Council of the Armenian Ministry of Health and on the basis of reviews by the following individuals: Prof M. D. Mashkovskiy, active member of the USSR Academy of Medical Sciences, head of the Pharmacology Laboratory of the All-Union Scientific Research Chemical and Pharmaceutical Institute imeni S. Ordzhonikidze; Prof A. A. Megrabyan, corresponding member of the USSR Academy of Medical Sciences; Prof G. Ya. Avrutskiy, head of the Psychopharmacology Department of Moscow Scientific Research Institute of Psychiatry, RSFSR Ministry of Health, and Prof G. S. Khachatryan, head of the Laboratory of Biosynthetic Brain Reactions, Yerevan State Medical Institute. The book was written in the department of psychiatry, Yerevan State Medical Institute (headed by Prof A. A. Megrabyan).

Foreword

The wide use of a new class of drugs--psychotropic agents--opened up new roads for treatment of mental illness. Unlike former methods of treating mental patients (insulin and electroconvulsive therapy), psychopharmacotherapy is characterized by relative safety and availability, not only in hospitals, but under

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extramural conditions, and mainly by the fact that it has high and selective therapeutic efficacy in most cases. Moreover, it makes it possible to implement simultaneously a combination of drug, sociovocational and psychotherapeutic treatment of psychopathological disorders.

However, in spite of the broad introduction into psychiatric practice of psychotropic agents that are diverse in efficacy, full advantage is still not being taken of their qualities as drugs for treatment of psychosis. The main point is that there is not always a differentiated approach used to dispensation thereof. For this reason, the method of "trial and error" continues to be used, on the basis of "what could help."

The task at this stage of development of clinical psychopharmacology is to work out and define validated indications and contraindications for various psychotropic agents, optimum methods of altering dosage, changing drugs, combinations thereof in accordance with the dynamics of the patient's clinical status and nosological essence of disease.

It must be stressed that psychopharmacotherapy, as a part of pharmacotherapy, is governed by the principles of strict dosing and purposeful orientation toward specific symptoms, syndromes and states. For this reason, the chief prerequisite for achieving psychopharmacotherapeutic success is a differentiated clinically validated approach to administration of psychotropic agents. On this basis, the choice of a drug, with due consideration of the range of its clinical action and method of administration, must be made not only on the basis of correct identification of the chief syndrome, but thorough determination of the clinical distinctions of the patient's condition before and during treatment, dynamics and rate of development of psychosis, its stage and stage within the range of nosological forms that present certain consistent patterns of development.

Of course, wise use of psychotropic drugs involves not only proper clinical assessment of the patient's condition, but to an equal extent it is determined by knowledge of general and individual distinctions of clinical and psychopharmacological effects of each drug, i.e., the intensity and quality of its spectrum of psychotropic activity (antipsychotic, sedative, thymoanaleptic, stimulant, psychotonic, antidepressant or depressant) and other psychotropic properties, depending on the prescribed dosage, as well as its ability to elicit possible somatic, neurological side-effects and complications. From the same point of view, it is also important to be informed on some theoretical questions related to the great complexity and insufficient investigation of mechanisms of psychotropic action of the main representatives of current psychopharmacological agents.

Consequently, the success of psychopharmacotherapy depends, first of all, on proper clinical evaluation of a patient's condition, careful individual selection of an adequate psychotropic drug with due consideration of its psychotropic activity, proposed method of treatment and dynamic change therein during therapy, rather than on the question of whether a "good" or "bad," "potent" or "mild" drug was used, since there is no clinical validation of such assessments.

However, no matter how great the role of psychopharmacotherapy among other methods of treating psychosis, exaggeration thereof could lead to mistakes. Combined treatment of disease is a mandatory prerequisite for achieving a stable therapeutic

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response, where an important place must be reserved for sociovocational readaptation and psychotherapy, the way toward which is opened, to a significant extent, by psychopharmacotherapy. The latter should not be set against insuline-comatose and electroconvulsive therapy, since they could be more effective than psychopharmacotherapy under certain conditions.

As shown by experience in treatment with psychotropic agents in our country, treatment of psychoses under hospital conditions is only the first stage of psychopharmacotherapy. After eliminating acute signs and determining the method for using a drug, prolonged therapy often continues under extramural conditions where, along with social and vocational rehabilitation, the patients continue with psychopharmacotherapy for a number of years. Stabilization of the therapeutic effect is achieved expressly under these working and social conditions, which are customary to patients. In this regard, the role of the dispensary is increasing significantly, where treatment begun at the hospital is continued under extramural conditions, rather than functioning solely to provide "maintenance" therapy.

All these and other rather essential aspects of psychopharmacotherapy are covered to a considerable extent in this handbook, which touches upon a number of important theoretical and practical questions. Knowledge thereof will help psychiatrists and physicians in other specialties in their everyday work.

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